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NO. 266, VOL. 11] THURSDAY, DECEMBER 3, 1874 [PRICE $5 PER ANN.

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The Institute will meet on TUESDAY, December 8th, at 8 o'clock p.m. precisely, when the following Papers will be read:—

1. "Notes on some Tumuli and Stone Circles near Castleton, Derbyshire." By Rooke Pennington, Esq., LL.D.—2. "Some Account of a Leaf-wearing Tribe on the Western Coast of India." By M. J. Walhouse, Esq.—3. "Further Notes on the Stone Monuments of the Khasi Hills." By Major Godwin-Austen.

J. FRED. COLLINGWOOD, Secretary.

SUNDAY LECTURE SOCIETY.—LECTURES at ST. GEORGE'S HALL, Langham Place, each SUNDAY AFTERNOON, at Four precisely. Sunday, Dec. 6:—WINWOOD READE, Esq. (Special Correspondent to the *Times*), on "The Ashantees."—Members' Annual Subscription, £1. Payment at the door—One Penny, Sixpence, and (reserved seats) One Shilling.

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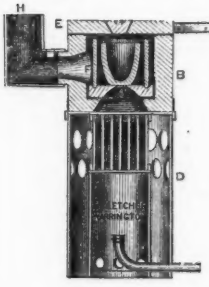

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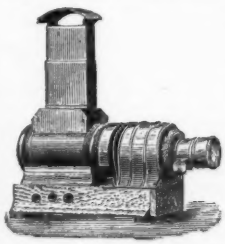

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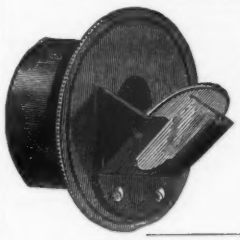

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THURSDAY, DECEMBER 3, 1874

SAXBY'S "BIRDS OF SHETLAND"

The Birds of Shetland, with Observations on their Habits, Migration, and Occasional Appearance. By the late Henry L. Saxby, M.D., of Balta Sound, Unst. Edited by his brother, Stephen H. Saxby, M.A. 8vo., pp. 398; eight plates. (Edinburgh: 1874.)

JUST as no country can show such a number of works on Ornithology as our own,* so no branch of our fauna has received anything like the same degree of attention, which the existence of such works implies, as birds. These works are of various grades of excellence, as might naturally be expected, but there are few that do not contain more or less valuable matter, and none that can be safely neglected by ornithologists; while some, as Mr. Stevenson's "Birds of Norfolk," Mr. Gray's "Birds of the West of Scotland," and of course Thompson's "Birds of Ireland," rise to a very high order of merit. The book now before us—the late Dr. Saxby's "Birds of Shetland,"—does not, indeed, nearly reach the standard of those just named as a whole; but in some respects it does not fall far below it, because the locality of itself gives an importance to the subject which no imperfections can impair—and the work certainly labours under several manifest and serious defects. It will be enough to mention three of them. First, there is the deplorable fact of the author's premature death, and the posthumous publication of his book consequent thereupon; for though his brother has doubtless done all in his power to discharge the duty of editor—and, let us say at once, has done this very creditably—the want of an author's final supervision is a severe injury to any work. Secondly, the author seems to have had to depend almost entirely on his own resources. In any but the very smallest district, it is nearly impossible for one man to know the whole of it, and this is quite impossible, even after a twenty years' residence, in a group of islands like the scene of Dr. Saxby's labours. He himself lived in the most northerly of those which are inhabited, and his connection by marriage with the influential family of Edmonston—which has produced so many gifted members—no doubt gave him unusual facilities for becoming acquainted with the peculiarities of Unst; but his professional duties in a great measure tethered him to one spot, and hindered him from carrying on his investigations in the more southern islands as he unquestionably would have liked to do. Thirdly, the author does not seem to have fully appreciated what the duties of a local naturalist in these days are. Twenty years ago even this book would have attained for him a very high rank among his brethren, but times have changed. So great is the advance in all branches of biology, that what then passed for the best of work is now far behind the age. The British ornithologist has become a more highly educated and better-read man than he was, and, what is more to the purpose, a man of wider views. He must not only know what are the general wants of his science at present, the problems which require solution, but, to take a good place, he must know also much mo e of what is being done by his neighbours than most of our forefathers in the pursuit cared to trouble themselves with. Lacking such knowledge as this, he is apt to miss the bearings of observations of the most interesting kind, and he is sure to be tediously minute upon matters which might or would have rejoiced his bird-fancying predecessors, but are of small moment to his contemporaries.

We do not write these words without pain. Every allowance must be made for the gentleman who secluded himself in the most northern of the British Islands, but many a man so placed would still have formed or kept up such an intercourse with the centres of thought and investigation as to enable him to be on a level, as to their results, with the best thinkers and investigators. Shetland, nowadays, in regard to communication, is hardly further removed from Edinburgh (or, for the matter of that, from London) than Selborne was in those of Gilbert White. Yet we find that White was in the front rank of the naturalists of his time, corresponding freely, frequently and on equal terms with the acknowledged heads of his vocation, testing by his own experience all that he learned from them, and, moreover, all that was known of the labours of foreign naturalists. *Maximis haud impar*, he criticised alike Linnæus, Scopoli and Kramer, Ray, Derham and Stillingfleet; and his criticisms are still defensible. Now, there is no evidence that Dr. Saxby did anything of this kind—an examination of his book gives no intimation that he was at all aware of what subjects were moving his brother ornithologists, whether at home or abroad. Most of his observations as they were made were transmitted for publication to a periodical which has been the delight of bird's-nesting and moth-pinning schoolboys, but, except in encouraging a taste for natural history among amateurs, it has been remarkable for persistently checking its scientific study. We do not of course blame Dr. Saxby for not occupying himself with species-splitting, nomenclature and such like refinements. They are only to be indulged in with profit by such as have ready access to museums and libraries, and are possibly not worth half the trouble that is taken about them by men who enjoy those facilities. But there were numberless subjects which were within his grasp, and yet are entirely overlooked by him. We may instance the many contested points as to the assumption of certain plumages by certain sea-fowls. A keen observer so favourably situated as Dr. Saxby, one would think, would have thrown some light on such questions. One of them relates to the various garb in which the bird, commonly known as Richardson's Skua, presents itself. The species is abundant, as everyone knows, in the Shetland seas; but not a word is vouchsafed to bring us nearer to an understanding of the matter. We are told, indeed, that parti-coloured birds and whole-coloured birds can be distinguished from the time that they are in the nest; but that much some of us knew before, either from our own experience or the testimony of others. Puzzles too, which, though perhaps

* Germany is of course the only one which can compare with Britain in this respect; and leaving out of consideration the difference in extent of the two countries, there can be little doubt as to the side on which the numerical superiority lies. It is true that in Prof. Giebel's "Thesaurus Ornithologiæ" the titles of British works occupy barely *six* pages against *nine-and-a-half* of German. But the latter are really collected with much amount of care, while the former, if not taken at haphazard, have been picked on some principle of artificial selection which defies inquiry. Had the British journals been examined by that learned compiler at all as closely as the German, the list of papers relating to the ornithology of the United Kingdom would have been more than doubled.

seldom discussed in public, have often been debated when two or three ornithologists are gathered together, are equally left without a word, while a word from Dr. Saxby would have been of the greatest value. Among such is that of the growth of the Puffin's monstrous bill. We have a very well told tale of the author's visit to a Puffin-warren on Hermaness, but it is just such an one as anybody not a naturalist would write, and contains nothing that dozens or scores of British ornithologists did not know before. Again, we may instance the migration of birds. An observer in such a look-out station as the extreme north of Shetland might, one would think, have furnished an infinite number of facts bearing on this important and perplexing question. Dr. Saxby contents himself with telling us when certain species come and go—very valuable information, no doubt, from so competent an authority; but as to the application of such facts, the impression they made as a whole upon his mind, their relation to similar observations in other places, not a word, so far as we can find, is said. Some of the Shetland migrants, we happen from other sources to know, touch the islands as their extreme western, others as their extreme eastern, limit; but this is all one to our author, who does not seem to care whence the wanderers come or whither they go; they are regarded by him as "the wind that bloweth where it listeth."

But enough of this unpleasing task. With the most sincere regret for Dr. Saxby's misfortunes and untimely fate, and a heartfelt sympathy with those who have to mourn his loss, we are compelled to say so much. The old adage *de mortuis* is very well in its way, but when we have him termed by reviewers "one of the first of our ornithologists," his book "a most valuable contribution to the ornithology of Great Britain," and all the rest of it, we must, if we speak at all, speak the truth. We could count at least a score of British ornithologists who, had their lot been cast in the Shetland Islands, would probably have done much better, and would certainly not have been contented to do so little. His intellectual and scientific capacity is reflected in his editor, who sees in the conductor of a popular magazine one "who has for so many years sat at the focal point" of ornithology—a metaphorical expression to which many meanings might be attached, one of which (though obviously not that of the writer) is that a focus may be found on a blank surface which receives rays of light and does not return them. The "Birds of Shetland" is a book of fair mediocrity. The next faunist, whose work we may be called on to review, will, we hope, take warning by its deficiencies, though for truthful observation—strictly limited, we must say, to observation—he cannot have a better model than Dr. Saxby. More, however, is expected of a faunist in these days.

MARSH'S "MAN AND NATURE"

The Earth as Modified by Human Action. A new edition of "Man and Nature." By George P. Marsh. (Sampson Low and Co., 1874)

AMONG the varied forms of energy by which the ceaseless changes of the earth's surface are produced—subterranean heat, air, rain, frosts, rivers, glaciers, the sea, and the rest—the geologist requires to include as a not unimportant agent, Life, both vegetable and animal. Some of the ways in which plants act in augmenting or retarding the operation of the inorganic forces are familiar enough. How often, for instance, do we see the walls of a ruin which have been split or cast down by the growing roots of some sapling tree which has found a footing in their masonry. The frosts and storms of winter would have levelled the walls in the end, but their action has been anticipated by the tree. Again, as an everyday example of the opposite kind of action, we may take the way in which the matted roots of trees which grow along the alluvial margin of a river serve to bind the loose sands or clays of the bank together, and retard the wasting effects of the current. Animals, too, have their own ways of effecting similar results, as every observant rambler in the country can testify. Moles, rabbits, and other burrowing animals lay bare the soil to rain and rivulet, and where they carry on their operations in loose materials liable to be dispersed by wind, as for instance on the sand-dunes by the sea, they may lead to the destruction of much valuable land under the drifting sand which they have uncovered. If we travel into other parts of the globe we find other and better examples, as in the dams of the beaver and the reefs of the coral-polyps. Less easily definable, but probably far more important, are the influences of life upon climate; for although the distribution of the fauna and flora of any region is in great measure regulated by climate, it is no less true that climate is modified by the flora, as is shown by the desiccation of countries which, once green and fertile, have been stripped of their woods.

So long as man remained in the savage state his influence resembled, and in some respects fell short of, that of the terrestrial animals who were his contemporaries. He felled a tree here and there, and when he had learned the use of grain, turned moorland into rude fields for culture. But his warfare lay not with the inanimate surface, but mainly with the beasts, fowls, and fish on which he chiefly depended for food and clothing. With the slow development of civilisation his influence as a geological agent has steadily increased, until now it must be ranked in the first class of the forces by which the surface of the land is modified. The time is yet too short during which accurate registers have been kept to admit of any very precise determination of the amount, sometimes even of the nature, of the changes effected by human action. But enough has been recorded to justify the attempt to indicate at least the general tendency of man's operations, while at the same time tolerably definite information exists regarding the results of some of his interferences with the ordinary economy of nature. In some respects man's influence is antagonistic to nature's usual modes of working, but of course, viewed broadly, it cannot do more than alter the balance of forces, giving to some a greater and to others a less share of work than in a natural state would be accomplished by them.

Mr. Marsh's "Man and Nature," published eleven years ago, was the first attempt, at least in English, to take a general view of this subject from a wide basis of reading. A work of research and generalisation from the labours of others rather than of original observation, it called attention to a field of inquiry too little cultivated by geologists. In fact, to its influence we may with pro-

bability ascribe the greater prominence now given in treatises of Physical Geography and Geology to the geological aspects of man's position on the globe. A new edition shows that the efforts of the author have not been wholly unappreciated here by that general reading public, not of professed *savans*, but of educated, observing men, to whom they were addressed. He must be gratified also to find that as his materials were in large measure derived from the observations of foreign writers, his work has met with a special measure of notice and approval on the Continent. It is frequently cited by recent French and German authors in Physical Geography and Geology, and a special Italian edition of it has lately been published under the author's supervision.

Of a book which has now established its position it is not necessary to say anything by way of criticism. This new edition has been somewhat enlarged, but the same division of subjects is retained. The author, who, besides being familiar with the characteristics of large tracts of his own country, the United States, has travelled extensively in Europe, brings his work abreast of the most recent discoveries and conjectures. The extent of his reading, remarkable enough in the first edition, is evinced again in this new issue. He seems to have come across the most out-of-the-way blue-book of the most out-of-the-way kingdom, and it has yielded to him some apposite illustration or suggestive fact. And even though we may be disposed to admire more the wonderful industry of research than the judgment in the selection of evidence, we cannot read even the most doubtful bits of testimony cited and commented upon without being made to think about what we may perhaps have noticed ourselves but never really reflected upon before. And there could hardly be a greater merit in a book than this. As to the change of title in this new edition, we are inclined to think it a mistake, for two reasons. In the first place, it is not in itself so good a title as the first; and in the second, the changes in the present edition are not sufficient to warrant the dropping of the name by which the book is generally known. This, however, is a small matter, and will not, we hope, damage the progress of a treatise which certainly ought to be one of the standard works of reference in the library of every well-educated Englishman.

BRINKLEY'S ASTRONOMY

Brinkley's Astronomy. Revised and partly re-written, with additional chapters, by John William Stubbs, D.D., Fellow and Tutor of Trinity College, and Francis Brünnow, Ph.D., late Astronomer Royal of Ireland, and Professor of Astronomy in the University of Dublin. (London: Longmans and Co., 1874.)

DR. BRINKLEY'S treatise on elementary astronomy, of which this is a new and revised edition, has been for many years one of the recognised text-books provided for the use of Trinity College, Dublin. We believe, however, that it is a work comparatively little known out of Ireland, and probably many English astronomers were not aware of its existence till its reappearance, in a new dress, under the able guidance and direction of Dr. Stubbs and Dr. Brünnow, by whom the present edition is revised, enlarged, and partly re-written. Its popularity as a text-book will doubtless be no longer confined to the sister island; for this treatise, although elementary in its character, contains such clear and concise explanations of some of the principal problems in astronomy, that its intrinsic merit alone will probably find for it a place among the choice volumes of every astronomical student, and also on the shelves of every astronomical library. We do not say that this "Astronomy" is all that can be desired, nor will it obviate the necessity for the employment of a more elaborate work on practical astronomy where extreme accuracy is required in the reduction of observations; but it does on the whole explain the different problems in a clear and easy manner and in popular language, without sacrificing those details which are necessary for a proper elucidation of the different problems. We should, however, have been glad if a more detailed account had been given of some of the subjects treated upon, especially in the chapter describing the instruments usually employed in making astronomical observations. The methods of determining the instrumental adjustments are sufficiently explained, but it would be of great service to amateur astronomers if examples had been given of the complete reduction of both meridional and equatorial observations, a kind of information rarely to be found in detail in astronomical treatises.

The name of Dr. Brinkley involuntarily carries us back so far into the history of modern astronomy that a doubt existed in our mind, before opening the book, that an astronomical treatise originally prepared so many years ago, even by so distinguished an astronomer, must necessarily retain much of an antiquated character, either in arrangement or material. Thanks, however, to the great practical knowledge of Dr. Brinkley, and to the editorial labours of Dr. Stubbs and Dr. Brünnow, we find the science is represented as accurately as if the work had been published now for the first time. In the days of Dr. Brinkley, directors of observatories did not consider it their duty to reduce their observations with that completeness which we are now accustomed to see. It was not till the present Astronomer Royal, Sir George Airy, was appointed to the direction of the Royal Observatory that the numerous observations of the moon and planets made at Greenwich since 1750 were reduced upon one uniform system, and of sufficient accuracy to be made available for the correction of the elements of the lunar and planetary orbits. Under these circumstances, many of the principal astronomical constants were not sufficiently determined in the early part of the present century, especially of those relating to observing astronomy, to admit of the production of a practical handbook in so satisfactory a manner as at the present day; but in all that was essential for the proper comprehension of the general planetary and lunar motions, no one had greater qualifications for such a task than the learned Bishop of Cloyne, who had himself, in addition to other researches on refraction and parallax, investigated the value of the constant of aberration from observations made with the 8-ft. circle at the observatory of Trinity College.

This introductory treatise is founded on a series of annual lectures on astronomy delivered by Dr. Brinkley before the undergraduates of Trinity College during his occupation of the Andrews Chair of Astronomy in the University of Dublin At the request of the College

Board these lectures were afterwards published, and they have since formed an important portion of the course of study required for the College examinations. For some time it was universally felt that the book was not in keeping with the advanced state of astronomical science, and that a new and revised edition was necessary. For this purpose, the authorities of Trinity College, who naturally have a traditional respect for this treatise, were fortunate in securing so accomplished an editor as Dr. Stubbs, and the co-operation of so distinguished an astronomer as Dr. Brünnow.

Seekers after the romance and history of astronomy will find in this volume few facts recorded in this interesting branch of the science, which the editors have apparently rightly considered as forming no part of a college text-book, for "the student who has made himself so well acquainted with astronomy as to find its history interesting will easily procure for himself, from a variety of authors, all the information he can desire." There is also a very limited amount of description of the physical aspects of the larger planets. We rather regret this omission, although there may be reason for doing so, for we believe that the book would have been more generally attractive and useful had some of the results of the numerous modern observations of the physical features of Mars, Jupiter, and Saturn been given. This treatise contains, however, what is far more valuable in a text-book, and which is often slurred over in many popular astronomical works of much higher pretensions, clear and concise explanations, accompanied in many instances with the formulæ of reduction, of various astronomical subjects. Among them we may name the theories of refraction and parallax, the phenomena depending on a change of position on the earth's surface, the motions of the moon and planets in their orbits, eclipses of the sun and moon, the application of astronomy to navigation and geography, the figure of the earth, the masses of the sun and planets, &c. A very fair description of the construction and use of the transit instrument, mural circle, and equatorial is also given, sufficient in fact to enable a non-practised but intelligent observer to understand easily the necessary adjustments required in the use of these instruments. There is an omission, however, though we could scarcely expect to find it inserted, as the method is only adopted in a few of the principal observatories, but a notice of which we are inclined to think would have been acceptable to many, and would doubtless increase the value of the section on astronomical instruments. We refer to the method of automatic registration of transits on a chronograph, instead of recording them by the ordinary or "eye and ear" method. It is true that the usual manner of making a transit is sufficiently explained, but as the chronographic registration is now frequently adopted in the determination of the differences of terrestrial longitudes, as well as in the ordinary registration of transits, we shall always be glad to see a description of the chronograph in every treatise on practical astronomy.

Besides considerable alterations in the arrangement of the subjects and additions to the text made by Dr. Stubbs, Dr. Brünnow has contributed new chapters on the physical constitution of the sun and heavenly bodies, on discoveries made by means of the spectroscope, on the proper motions of the fixed stars, and on the general advance of stellar astronomy. We need not remark more on these chapters than that the great astronomical reputation of Dr. Brünnow is a sufficient guarantee of their accuracy, and to observe that the principal results of the recent researches are given in a concise form, which makes these chapters most interesting as well as valuable reading.

We have hitherto given to this excellent treatise an almost unqualified approval, but there are one or two points of no great moment which we should like to see corrected in a future edition. Nothing offends the eye of an astronomer more than to see in an astronomical text-book errors in the orthography of well-known proper names. We have detected a few of such errors which ought to have attracted the attention of the editors if not of the printer. "Flamstead" for *Flamsteed* might reasonably be passed over in silence; but when we see "Faumalhaut" printed for *Fomalhaut*, "Fourcault," more than once, for *Foucault*, "Leomis" for *Loomis*, "Maskeline," more than once, for *Maskelyne*, we cannot avoid feeling a pang of regret that in an educational work on the science such inaccuracies should have been allowed to pass. Again, it is unfortunate that greater care was not taken to correct the distances and magnitudes of the members of the solar system, depending upon the recent alteration of the value of the solar parallax, especially as the new value of the sun's distance in miles is frequently given. The old value in miles for the velocity of light per second, 192,000, might also have been corrected for the same reason. On page 152, the value of the solar parallax determined from Foucault's experiment is 8″·86, *not* 8″·942, this latter value being sensibly the same as that determined finally by Mr. Stone from a comparison of the Greenwich observations of Mars at the opposition in 1862, with the corresponding observations made by Sir Thomas Maclear at the Cape and by Mr. Ellery at Williamstown, Australia.

Notwithstanding these few slight drawbacks, we do not hesitate to recommend this most excellent treatise, which is moderate in price, to all who are interested in astronomical observations and in the progress of astronomy.

OUR BOOK SHELF

A Peep at Mexico. By John Lewis Geiger, F.R.G.S. (London: Trübner and Co., 1874.)

MR. GEIGER'S book is chiefly devoted to a description of the not well known country westward of the town of Mexico. The route of his journey was from Manzanillo, on the coast of the Pacific, *viâ* Colima, Zacoalco, Guadalajara, Guanajuato, and Querétaro, to the capital.

The book gives but a "peep" at Mexico, but it is a very agreeable one; for, not entirely relying on his pen to describe what he saw, the author photographed *en route*, and forty-five views illustrate his book. Although the people, their habitations, and their ways, are the principal topics on which Mr. Geiger writes, yet here and there he gives glimpses of the natural history of the country. For example, the first part of his journey from Manzanillo was along the Laguna de Cuyutlan, which runs parallel with the shore, separated from the ocean by only a narrow strip of land. "It is almost completely enclosed by mangrove jungle, which overruns the banks and creates numerous islets by its growth where the water is shallowest. . . . There is no

variety in the vegetation; mangroves monopolise all available space." The stagnant waters he describes as covered with a brownish green slime, disturbed occasionally by an alligator.

"Some spots were literally crowded with numerous varieties of ducks and teal. . . . Their cackling would often alarm a company of huge white cranes, quietly congregated on a sandbank. . . .

"On the floating islands, proud storks and sedate melancholy herons were engaged in catching and consuming their breakfast, whilst every nook of the mangrove thickets, every shallow in the lake, every log of wood on the water, was tenanted by all manner of birds, including alike the busy wagtail, the grandfatherly pelican, and the stately flamingo. As we cut the placid waters, a brace of neat sand-pipers or a swift kingfisher, scared by the snort of the engine, would suddenly emerge from the margin of the channel, and, darting ahead, be again frightened into the air almost before they had settled.

"Soaring in graceful circles far overhead, a variety of hawks view the scene from aloft, ready to pounce upon whatever appears an easy prey; whilst thousands of dark-blue glittering swallows hurry from island to island, feeding plenteously on the myriads of insects that hover above the water."

The vegetation near Colima is thus described:—

"The trees are not large, but are so interwoven as to form impassable barriers, even apart from the bushes and shrubs that spring from every spot of vacant ground. Hundreds of creepers cling to every trunk, and twine round every branch, connecting by a thousand wiry threads, thickets, shrubs, and cacti—a massive bulwark of profuse vegetation, through which the axe alone can hew a way. The huge *Organo* cactus, with its tree-like stem, often 2 ft. in diameter, and 10 ft. to 15 ft. high, sends up its stiff, straight branches to a height of 30 ft. or 40 ft. from the ground, whilst the smaller species mingle in thousands with the shrubs and bushes nearer the earth. Wherever the creepers may have neglected trunk or bough, prolific parasites, gay alike with taper leaf and gorgeous blossom, hasten to perform their part in this fairy work of nature. The flowers have little scent, but their profusion of white, yellow, and red, blended with the countless shades of green, charm the eye with tints as various as they are magnificent."

Beyond the fact of mentioning lava near Colima, Mr. Geiger has made no attempt to give any geological information, and the principal physical feature noticed is that the country is much broken up by *barrancas*, narrow ravines, which sadly interfere with the making of straight roads. The book is full of interesting information about social life.

Les Roses:—Histoire; Culture; Description. Par Hippolyte Jamain et Eugène Forney; préface par Ch. Naudin. 60 chromolithographies d'après nature, par Grobon. 2me edition. (Paris: J. Rothschild.)

LIKE so many of our garden-flowers, the history of most of our cultivated varieties of the rose is involved in obscurity. A few species, as *Rosa centifolia* (the Cabbage Rose), *gallica*, *damascena* (the Damask Rose), *moschata* (the Moss Rose), *lutea* (the Yellow Rose), have retained their distinguishing characters; but the majority of the florist's flowers are the result of hybridisation or variation, in which all trace of their nativity is lost. The same is the case also in Western Asia, the rose which yields the famous attar of roses being of very doubtful origin, probably a form of *R. damascena*. In the work before us we have a history of the cultivation of the rose, followed by a description of the various species and varieties, with their geographical distribution; an account of the various modes of cultivation; and a history of the diseases and insect enemies to which it is liable—all embellished with very beautifully executed woodcuts. The greater part of this handsome volume is occupied by sixty chromolithographs of well-known roses, which are triumphs of the engraver's art. The colours are so truthful, and the execution so clear and brilliant, that even in engravings coloured by hand you could scarcely obtain more accurate or beautiful illustrations. The volume is one that deserves a place on every drawing-room table.

LETTERS TO THE EDITOR

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts. No notice is taken of anonymous communications.*]

Dr. Petermann's Letters to the Presidents of the Royal Geographical Society in 1865 and 1874

THE letter from Dr. Petermann to the President of the Royal Geographical Society, dated Nov. 7, 1874,* refers to what took place ten years ago, and to the two letters which he then addressed to Sir Roderick Murchison on the subject of arctic exploration, a subject on which he then, as now, assumed for himself the right of speaking as an authority. There are many geographers who feel very strongly that Dr. Petermann did great injury to the cause of arctic discovery in 1865, and it seems desirable that as he has again put himself forward as an authority, his pretensions to that character should be examined.

Captain (now Admiral) Sherard Osborn read an exhaustive paper before the Royal Geographical Society on Jan. 22, 1865, in which he advocated a renewal of arctic exploration by the route of Smith Sound. The long series of voyages in the direction of Spitzbergen had proved, by a process of induction, that the Smith Sound route was the one that should be followed; while the development, during the Franklin searches, of that system of sledge travelling with which the name of M'Clintock is associated, caused a revolution in the method of exploring, and must be looked upon in the light of a discovery. From that time it has been known that land must be the basis of polar exploration, that a real advance can only be made by following the land-ice, and that sending ships into the drifting packs between Greenland and Novaya Zemlya is a useless waste of time and money. Sir George Back, Admiral Collinson, Sir Leopold M'Clintock, Admiral Sherard Osborn, Captain Vesey Hamilton, and other arctic officers practically acquainted with the subject held that view in 1865, and they hold it now. Their opinions were based on practical experience and on the records of former voyages, and nothing has occurred since either to alter or to modify them.

Admiral Osborn's proposal was cordially supported, and there appeared to be good reason to expect that it would be unanimously accepted; when two letters from Dr. Petermann to Sir Roderick Murchison, by causing a useless and barren discussion, had the effect of destroying these fair prospects.

Dr. Petermann has no practical knowledge whatever of the arctic regions. He is famous for having propounded a theory more than twenty years ago, and he has ever since striven to make the obstinate facts fit into it—a hopeless task. So that while he has no actual acquaintance with the polar regions, the exigencies of his theory prevent him from judging of what he reads with an unbiassed mind. It was in January 1852 that the Petermann theory was first given to the world, in the form of a "Plan of Search for Sir John Franklin." The theory is that there is an open sea round the pole, caused by the Gulf Stream, and that it can be reached late in the autumn with perfect ease, by sailing north between Spitzbergen and Novaya Zemlya. He urged that Franklin's ships were beset near the coast of Siberia, and that the way to reach them was by sailing across the polar ocean during the winter.

This is the Petermann theory. It might have been very mischievous in 1852, by diverting the search from the proper direction; but fortunately it was considered absurd, and received little or no attention. Unluckily for the cause of arctic research, Dr. Petermann resuscitated his theory in a modified form, in his two letters to Sir Roderick Murchison, in which he advocated the Spitzbergen route in 1865.

Dr. Petermann assigned eight reasons for his preference, which are easily disposed of. His first reason was that the voyage from England to the North Pole is shorter by Spitz-

* Published in NATURE, vol. xi. p. 37.

bergen; a matter which may be important to a company wishing to establish a line of packets between the two points, but which has no bearing on the question of exploration. His second reason was that the Spitzbergen seas form the widest openings into the unknown region. This is one of the strongest objections to the route, for the navigation must be conducted in a drifting pack, which is fatal to a successful advance. The third reason is still more remarkable, namely, that the "Spitzbergen seas are more free of ice than any other part of the arctic regions." This assertion is diametrically opposed to the experience of all who have visited those seas. The fourth reason is that "the drift ice north of Spitzbergen offers just as much or as little impediment to navigation as the ice of Baffin's Bay." This statement is made in the face of the fact that a fleet of whalers has annually passed through the ice of Baffin's Bay for the last fifty-six years, while the pack north of Spitzbergen has never once been penetrated. The fifth assertion is that "the sea north of Spitzbergen will never be entirely frozen over, not even in winter, nor covered with solid ice fit for sledge travelling." This is possibly true, and it forms another strong objection to the Spitzbergen route, for these streams and pools of water, while making exploration by sledges impossible, would add to the danger of wintering in the pack. The sixth assertion is that from Sir Edward Parry's furthest point a navigable sea was extending far to the north, and that in 82° 45′ there was a perfectly navigable sea. The assertion is the very reverse of the real fact. Parry, at his extreme point, found the ice thicker and the floes more extensive than any he had previously met with, and there was a strong yellow ice blink always overspreading the northern horizon, denoting field-ice. The seventh assertion is that "the polar region north of Spitzgergen consists of sea and not land." This is the very reason that the Spitzbergen route is the worst that can be selected, land and land-ice being essential to a real advance. The eighth and last reason is that Parry's voyage only took six months. Here is another reason against the example being followed, for a hasty voyage of that kind must fail to secure the scientific results to be obtained from arctic research.

So much for Dr. Petermann's first letter to Sir Roderick Murchison. The only point in the second letter is the argument that there will be no difficulty in boring through the polar ice-fields north of 80°, because Sir James Ross got through the extensive pack in the antarctic regions in lat. 62° S., after it had drifted and become loose for many hundreds of miles over a boundless ocean. The fallacy of this comparison was fully exposed by Admiral Collinson.* That arctic explorer pointed out that the antarctic pack was drifting away from a solid line of immovable grounded ice-cliffs, and of course left open water in its rear, because there was no moving ice further south to take its place. The exact analogy of the voyage of Sir James Ross in the south is that of Scoresby in the north. The antarctic pack, in lat. 75° S., is analogous to the ice met by the whalers in the early spring in 75° to 76° N., through which they can usually pass. The open water north of Spitzbergen is analogous to the open sea found by Ross in the south; and the polar pack which Scoresby found bounding that open water to the north, from whence the ice he had passed through had drifted, is analogous to Ross's line of impenetrable ice barrier.

Dr. Petermann finally asked for any reason, however slight, why it would not be as easy to sail from Spitzbergen to the pole *and back* as to go up Baffin's Bay to the entrance of Smith Sound. This is a curious instance of the way a preconceived theory destroys the power of seeing the simplest facts. The reason is clear enough, and is well known to all arctic navigators. North of Spitzbergen the sea is encumbered by a drifting pack, through which no ship has ever penetrated. In Baffin's Bay there is land-ice, along which vessels can creep while the pack drifts past. The consequence is, that whereas a fleet of whalers passes up Baffin's Bay every year, no vessel has ever gone far into the pack north of Spitzbergen.

Although these fallacies were completely exposed at the time, the letters containing them caused a barren discussion which gave the appearance of dissension among geographers, and destroyed the previously hopeful prospect of the English Government being induced to consider Capt. Osborn's proposal favourably. Unanimity was essential to success; and thus Dr. Petermann's inopportune letters had the effect of throwing back arctic discovery for ten years.

At the same time the efforts of Capt. Osborn and his fellow arctic voyagers in 1865 bore some good fruit. His own paper is an important document, which clearly states the true principles of arctic exploration, and has been invaluable for reference. Dr. Hooker prepared a statement of some of the scientific results of an arctic expedition; and Commodore Jansen, of the Dutch Navy, contributed an admirable memoir on the discoveries and proceedings of his countrymen in the Spitzbergen seas.

Having thus seriously injured and retarded the progress of discovery, so far as England was concerned, Dr. Petermann called upon his own countrymen, with some success, to undertake arctic voyages in pursuit of his theory. Two or three such voyages were undertaken. In 1868 the *Germania* made a voyage to Spitzbergen with exactly the same result as had attended the hundreds of voyages which preceded it; and in 1869 another *Germania* followed the track of Capt. Clavering in 1823 to the Pendulum Island, on the east coast of Greenland, adding nothing whatever, so far as navigation is concerned, to our previous knowledge. Capt. Koldewey commanded both these expeditions, and he returned after being fully convinced of the fallacy of Dr. Petermann's theory, and that Smith Sound is the route for effective north polar exploration. It is much to be deplored that these gallant German explorers, who certainly might have done really good work if they had been guided by the practical experience of their predecessors in arctic navigation, should have been made to waste their energies in accordance with a fanciful and baseless theory.

The other arctic work that has been achieved since 1865 was not undertaken under Dr. Petermann's auspices, or to prove his theories; and the results have been much more important. The Swedes have done admirable scientific work in Spitzbergen. The Norwegians, under the auspices of Prof. Mohn, of Christiania, have circumnavigated Spitzbergen and Novaya Zemlya, and revisited Wyche's Island in 79° N., which was discovered by an English ship in 1617. Capt. Hall sailed far up Smith Sound, proving the accuracy of Admiral Osborn's views; and lastly, Lieut. Payer and Capt. Weyprecht discovered the extensive region between Spitzbergen and Novaya Zemlya, and proved the utter fallacy of Dr. Petermann's theory, which he propounded in 1852, and has since so persistently adhered to. The ice drifted with the wind, and there was no sign either of a warm current or of a navigable polar basin.

In 1872 Admiral Sherard Osborn read his second paper, again urging the renewal by England of arctic exploration by the route of Smith Sound, with the west coast of Greenland as a base. Fortunately, complete unanimity was secured, and, thanks to the tact, judgment, and perseverance of two successive Presidents of the Geographical Society—Sir Bartle Frere and Sir Henry Rawlinson—the Government has resolved to fit out a naval arctic expedition of discovery to proceed by way of Smith Sound. Success has thus at length crowned the efforts of the Society, and baseless theories have had to give place to the experience of practical men.

Yet we have been again visited by a long letter from Dr. Petermann, which, however, did not arrive until the question was settled. Its precise object is, therefore, not very apparent; but, remembering the injury done by the two previous letters in 1865, it is certainly incumbent on those who have, after much labour and watchfulness, reached the goal, to defend the ground which has been gained, even when the old opponent has become apparently harmless.

In his third letter Dr. Petermann begins by the assertion that actual exploration since 1865 has proved that there is "greater navigability in all parts of the arctic seas than was formerly supposed to exist." There is really no ground for this assertion. Our knowledge of the arctic seas previous to 1865 has not been increased to any material extent, and the amount of navigability in those seas was as well known before that date as it has become since. The voyage of Capt. Hall, satisfactory as it is, merely proved that practical arctic men were right, and that the theorists were wrong; and although it is very generous of Dr. Petermann to withdraw his opposition to the Smith Sound route, he must surely be aware that the time has now passed when that opposition would have any effect. If the voyages since 1865 have not added much to previous knowledge, they have at least had the effect of disproving a theory which has done more than anything else to retard discovery.

Most of Dr. Petermann's letter consists of a recapitulation of the work accomplished by the Norwegians on the coast of Novaya Zemlya, and by other recent voyagers, the point of which is not apparent; and of an attempt to make out that Payer and Weyprecht were not the discoverers of Franz-Joseph

* Royal Geographical Society's Proceedings, ix., p. 118.

Land, but that it was visited previously by Baffin and by Cornelis Roule. His arguments are not at all borne out by the authorities to which he refers. Nor will the British Government be guided by any proposals not originating from those experienced arctic officers upon whose advice they rely, so that Dr. Petermann's suggestions about sending one steamer to the west coast and another to the east coast of Greenland might have been spared.

English geographers have always fully recognised the valuable services of Dr. Petermann as a cartographer, and the important and useful work he has long done in collecting and disseminating geographical information. But at the same time it cannot be forgotten that his persistent adherence to an indefensible theory has retarded discovery, and that in 1865 his inopportune interference had a most injurious effect upon the prospects of arctic exploration from this country. That danger is at last overcome, but those who have borne the heat and burden of the day, cannot but protest against Dr. Petermann's present assumption of the position of an arctic authority and adviser.

Nov. 22 CLEMENTS R. MARKHAM

The Present State of the Arctic Ice Barriers

IN a letter from Capt. David Gray, quoted by Dr. Petermann (NATURE, vol. xi. p. 39), some very interesting observations on the arctic drift ice of this year's summer are recorded, which Capt. Gray regards as justifying the conclusion that "nearly the whole of the ice was driven out of the arctic basin last summer."

Capt. Gray's observations appear to be limited to the coast of Greenland. If corresponding phenomena were presented in other and distant parts of the Arctic Ocean, they must afford strong confirmation of his conclusion. I have lately returned from a summer visit to Arctic Norway, having sailed round the North Cape and into the Varanger Fjord, stopping a few days at Tromsö and halting at Hammerfest, Vardö, Vadsö, and other arctic stations, and I was much surprised at the curious difference between the climate I found there this summer and that which I previously experienced at the same season.

The following extract describes the temperature between Tromsö and Hammerfest during my first visit in July 1856:—"The weather was excessively hot. During the hottest part of the day the thermometer stood at 77° in the cabin, at 92° in the smoking saloon—a little cabin built on deck—and 108° in the sun: on shore, in the valleys, it must doubtless have been much hotter. The contrast of this glaring Italian, or I might almost say Brazilian sky, with the snow-clad rocks and glaciers dipping almost to the sea-edge, is very striking. It was a continual source of wonderment; one of the few scenes which one does not become accustomed to, but retains its novelty day after day."* Such was the prevailing weather during the summer of 1856, and such is the usual summer weather of Arctic Norway from the beginning of July until a week or two after the disappearance of the midnight sun. This year it was miserably different, to the great disappointment of the ladies I ventured to pilot thus far, and vexation to myself. The contrast was strikingly shown in the course of a walk up the Tromsödal. This summer I made two excursions up this valley with a fortnight's interval. On both occasions the lower part of the valley was a mud swamp from recent snow-thaw. In 1856, three weeks earlier in the season than my second visit this year, the snow water had evaporated, leaving the path hard and dry. In 1856, the poor little Lapps were outside their huts, gasping with heat and varnished with oily perspiration; their huts were so insufferably hot that only one or two out of a party of seven or eight male travellers dared to venture inside. This year, the ladies, as well as myself, were glad to warm ourselves by sitting round the hut fire upon the boulders that serve as chairs. Drizzling rain and cold mists replaced the oppressive heat, the brilliant sky, and rainless summer-time of 1856.

The Duke of Roxburgh, who has spent sixteen summers in Arctic Norway (he has the Alten salmon river opening in lat. 70°), told me that the low temperature and drizzling mistiness of this summer was quite exceptional to his experience; that the summer of 1868, which was memorably cold, was not so bad as this. The usual crops of rye and potatoes were expected to fail completely this summer.

This unusual summer is the more remarkable when compared with that of England, which, judging by the abundance of the wheat crop, must at least have reached, if not exceeded, the average of mean warmth. The exceptional arctic summer must have been due to some exceptional arctic influence. The southward drifting of large quantities of polar ice, and consequent removal of some of the barriers that stand between us and the north pole, will account for what I have described, provided the loosened ice was sufficient in quantity and eastward extension.

The North Cape, though in lat. 71°, is not visited by icebergs; the sea there, and for some distance further north, is sufficiently warmed by the Gulf Stream to remain quite open all the year through. The free northward exposure must, however, render this part of the Arctic Ocean very susceptible to the cooling influence of an unusual southward drift of polar ice, and the peculiarities of this year's summer were exactly those which such an abnormal cooling of the sea would produce. These were evidently exaggerated over the open sea a little further north. During the few fine days we had while going round the island of Magerö, the sun was visible until about 11 or 11.30 P.M., but on approaching the north horizon it dipped into a mist-bank which hung with apparent permanency over the northernmost and most distant part of the sea. As we were desirous of seeing the actual orb of the sun quite at midnight, this repeated disappearance just at the critical time was of course especially noted. I afterwards learned that on these same nights, when the midnight sun thus played at hide-and-seek with us over the Arctic Ocean, it was clearly seen by spectators further south, who had a land or near coast horizon.

These facts, in conjunction with "the important information" given by Capt. Gray, justify us, I think, in looking forward very hopefully for important results from the proposed Arctic Expedition, and afford strong reasons for avoiding any possible source of delay that might stand in the way of an early start to make full use of next summer. W. MATTIEU WILLIAMS

* "Through Norway with a Knapsack," p. 139.

Zoological Gardens, Regent's Park

I MUST trouble you with a few words in reply to your correspondents "Viator" and Mr. C. Traill (vol. xi. p. 67.)

It is quite true that our gardens in the Regent's Park are "*too small in area*." We have for many years endeavoured to get them enlarged; but all we have succeeded in obtaining is the slip of land on the north side of the Regent's Canal, where the new North Entrance has been made. If "Viator" has any influence with the First Commissioner of Works, and can persuade him to grant us a further extension on the south side, we shall be truly grateful.

I admit also that the larger carnivora are at present badly housed, and that their dens are much too confined. This, however, will, I trust, be remedied by the erection of the new Lions' House, which will be commenced early next year.

The plan of establishing a second Garden for breeding purposes out of London was adopted by the Council some years ago, but was not found to answer. It has, however, many advantages, and may be again tried when our funds shall permit of it.

"Viator" finds great fault with our drainage. He cannot be aware that the Sanitary Authorities of the district, who have been much exercised in this matter, have pronounced us free from all blame.

Finally, I may say, without any wish to disparage the continental gardens (with all of which I am well acquainted), that none of them can vie with those of this Society in the extent, variety, and completeness of its living collection, or in the rarity of many of the objects exhibited. That this collection is appreciated by the public is fully evident from the yearly increasing number of visitors and the continual augmentation of the list of members.

As regards the remarks of Mr. Traill, I have to observe that the Society's "Proceedings" contain several papers by the Secretaries and Superintendents of the Gardens relating to points in the economy of the animals in them; and that the Prosector (whose office was created mainly with the hope of utilising the collection more completely in a scientific point of view) has lately devoted considerable attention to this subject, on which he will, no doubt, ultimately give us the benefit of his observations.

Dec. 1 P. L. SCLATER

Utilisation of Aquaria

I SHALL be glad if you will allow me to use your columns as a medium of inquiry with regard to the Brighton and Manchester Aquaria. Are there any arrangements in force already, or contemplated, whereby these fine institutions can be utilised for the promotion of zoological research? If I am not mistaken, the

British Association, at its meeting at Bradford, appointed a committee, the function of which was to see what arrangements of this nature could be carried out. I am not aware, however, that the committee has ever made any report, or if it has arrived at any conclusion on this subject. INQUIRER

Nov. 24

Discovery of Remains of Plants and Insects

I THINK I informed you about two years ago of the discovery of a bed of plants, with leaves, and a great variety of seeds, in this locality; also the wings of a Libellula, and the beak of a bird. As little interest was attracted, I have not hitherto informed you of the subsequent finding of a bed of insects—flies, gnats, and the larva and pupa of the latter, the larva in countless thousands—also the wings, in great numbers, of a variety of flies, butterflies, and one or two grasshoppers; also a wing resembling that of the Mole Cricket. There are, likewise, two or three beetles. The insects and wings are frequently associated with a very pretty Lymnea, in considerable numbers, and an occasional Planorbis, both retaining a high polish. I have also noticed a solitary small white Cyclostoma in the same bed. There are, I think, two feathers among the specimens obtained. Perhaps, as some interest has been shown in a similar discovery in Scotland, some of your readers may like to be informed of this. I am much indebted to the Rev. T. G. Bonney, of St. John's College, Cambridge, to whom you referred me, for advice and encouragement in examining these beds.

Gurnet Bay, Nov. 23 E. J. A'COURT SMITH

Sounding and Sensitive Flames

IN a letter which I have just received from Dr. A. K. Irvine, of Glasgow, my attention is drawn to a short abstract of some of his experiments with Barry's sensitive flame, which appeared in the *English Mechanic* of Dec. 15, 1871, a few months previously to the appearance in the *Journal of the Franklin Institute*, and in the *American Journal of Science*, of the description, referred to briefly in my last letter (NATURE, vol. xi. pp. 6 to 8), of Mr. Geyer's researches on the acoustic properties of the same flame, some particulars of which Dr. Irvine appears also to have noticed independently. The few lines in which his observations are recorded corroborate so fully the character and mode of action of the flame as now pretty perfectly established, that a short extract from them will scarcely be without interest, from the satisfactory support which it offers to the accounts and explanations that other investigators of this flame have elsewhere given in graphic terms of its appearance.

After noticing that it can be produced with an ordinary street-lamp burner (perhaps the straight quill-form, still to be met with in some streets of Glasgow, is here meant), as well as with pin-hole jets of steatite; and that whatever kind of gauze may, with slight differences of the effect, be used, the further the wire-gauze can be removed from the burner without the flame breaking or flattening (? fluttering) on the gauze, the more sensitive is the flame,—Dr. Irvine continues to describe the further characters of the flame as follows:—

"4. The roaring which takes place when any sound disturbs the flame is evidently in consequence of the greater proportion of air which mixes with the gas before passing through the wire-gauze; in short, when it roars and flattens on the gauze, it is an explosive mixture that burns.

"5. If a suitable tube (for instance, a paraffin lamp chimney of proper dimensions) is placed on the wire-gauze, it will be found that a musical note is produced every time the flame is disturbed by a sound with which it sympathises.

"6. A mixture of any inflammable gas and air passing through wire-gauze, over which a suitable chimney is placed, will give a note varying in pitch with the dimensions of the chimney and size of the flame."

Proceeding on this principle, Dr. Irvine adds that he had recently constructed and patented a form of miner's safety-lamp, which, when an explosive mixture of gas and air enters it, gives an audible signal of the dangerous condition of the mine.

It may be questioned if it is quite safe to excite rapid vibrations of a gas-flame burning on the wire-gauze inside a safety-lamp placed in an explosive atmosphere; but if any vibrations of the flame that are thus produced are limited (as it appears possible to ensure, by a proper construction of the lamp) to the extremely small oscillations of a high-pitched note, then no elements of danger in this new contrivance need necessarily be introduced or apprehended from the sounding action of the flame. In this and in other cases of their employment which have suggested themselves to experimenters on the acoustic properties of gas-flames, there seem to be hopeful promises of advantageous application of the sensitive and sounding properties that certain gas-flames possess in a very high degree. But it is to the explanation of the cause of the prostration, and to the account of the case of musical sensitiveness in Barry's wire-gauze flame when disturbed by external sounds, that it is particularly desired to direct attention in the foregoing extract from Dr. Irvine's brief description. The reason that the author assigns to them, and thence to the monitory action of his singing safety-lamp, that increased inflammability of the burning gas-mixture is at once the source of the sensitiveness, silent or sounding, of the wire-gauze flame, and the necessary condition of the atmosphere for the alarm note sounded by the newly invented safety-lamp, is so clearly expressed and illustrated by the order of his experiments, that as regards the probable mode of action of the disturbed gas-current adopted to explain the sensitive effects observed, there can be no doubt of the correctness of Dr. Irvine's view.

The gas-current, before reaching the wire-gauze, will naturally entangle and mix with a larger quantity of air when it is disturbed, by presenting a greater surface to the air in that state than when it issues smoothly. In the latter case it is not inflected into the tortuous wave-line of many folds and curves into which it must be bent on leaving the burner and passing from a fixed jet into an atmosphere oscillating rapidly to and fro under the action of external sounds. The sound-wave of the air into which it flows thus serves to incorporate more air with the upward stream and to render the combustion of the mixture more condensed and prompt, and the appearance of the flame in consequence more contracted and boisterous than when the gas-jet burns in a surrounding atmosphere of quiescent air.

Newcastle-on-Tyne, Nov. 14 A. S. HERSCHEL

SCIENCE IN MUSIC

AT the first meeting of the Royal Society on Thursday evening, the 19th ult., a paper was read by Mr. A. J. Ellis, F.R.S., on "Musical Duodenes." This formed the conclusion of a series of papers (the preceding ones having been published in the Minutes of Proceedings) on Just Intonation and Temperament in Music.

The author explained the defects of the ordinary keyed instruments, such as the pianoforte and organ, which were limited to twelve sounds in the octave, and were now tuned by a system which he characterised as the "worst possible," every element of harmony in them being put out of tune in all keys. To produce just intonation, it was necessary to have many more than twelve sounds in the octave; and he exhibited a chart giving a classified list of seventy-eight such notes, distinguished by the ordinary musical signs, with the addition of certain other marks which defined exactly the pitch of the notes, while their respective positions in the chart gave, by simple inspection, a correct idea of their relations to each other. Mr. Ellis then stated that as the large number of notes required by correct theory became troublesome in practice, the plan had been adopted of sacrificing absolute truth in some instances, and introducing a trifling error, by which means the requisite number of notes was much reduced, while the error was so small as not to offend the ear in any sensible degree.

Having determined thus on the number of notes to be used, the practical problem arose how best to introduce them in an instrument. Many contrivances had been suggested, involving new key-boards and modes of fingering; but considering the difficulty of introducing changes of this kind, preference was given to other plans, which retained the twelve notes of the ordinary key-board. To enable such a system to be carried out, it was necessary to make choice of certain *sets* of twelve notes, to be used when playing in certain keys; and to furnish information to guide these selections was the chief object of the paper. Such a set of twelve notes was called by Mr. Ellis a musical *duodene*, and the chart exhibited many of these

combinations, the properties of which and their appropriateness for particular cases were easily ascertainable.

Mr. Ellis, while deprecating the introduction generally of musical performances under the guise of lectures, illustrated his propositions by showing the effect of several instruments of fixed tones, concertinas and harmoniums, tuned in different ways. Some short harmonical passages were played, first on a harmonium of the ordinary kind, secondly on another with absolutely just intonation, and thirdly on a newly-constructed harmonium tuned on Handel's plan of the old organ temperament, but with the addition of several other notes enabling music to be played in all keys, equally well in tune. These additional notes were brought into use by draw-stops, each of which made an enharmonic change in one note, as from C sharp to D flat, G sharp to A flat, and so on. The stops were arranged before commencing the piece according to the key it was in, and they could be instantly altered at any time during its progress, if required by modulation. In this instrument the major thirds (the intervals to which the ear is most sensitive) were all justly in tune, but the fifths and minor thirds were a little flat; the ear, however, tolerated these slight errors much better than the extremely discordant error of the major third in equal temperament, and the effect of the harmony as played upon it was a great improvement on that plan.

Mr. Ellis, in the course of the paper, made frequent mention of the views of Helmholtz on harmony and temperament, and illustrated them by examples.

After the reading of the paper, Dr. Pole, F.R.S., remarked that Mr. Ellis's method of treating the elements of the musical scale had much originality, and had an interesting bearing on the structure of harmony generally; its principal object appeared, however, to be, in continuation of the author's former labours, to facilitate the production of correct intonation in music, an object of much importance. He would remind the meeting what was the present state of matters in regard to this. The fact was, that at present it was but seldom possible to hear what true harmony was like, as the great majority of music-producing instruments, namely, all those with fixed tones, were deliberately and systematically tuned false, with an amount of error painful to a sensitive ear. When he, a day or two ago, put his fingers on Mr. Ellis's just harmonium, he uttered an involuntary exclamation of surprise, for he had not heard the true harmony of a common chord for some time before. The public had only two opportunities of hearing true harmony: one when a stringed quartett was played by fine players; the other when a vocal unaccompanied piece was sung by first-rate singers. In each of these, the performers, being untrammelled by the odious temperament, gave way to the dictates of their correct ears, and produced true harmony. Every person of musical taste knew well the delightful impression produced by this kind of music. In modern oratorios it was very customary to insert, as in "Elijah," for example, an unaccompanied vocal piece, which was always rapturously applauded. Yet few people thought of the cause; it was not the composition, for the same music, when played on tempered instruments, was quite another thing; it was not even the skill of the performers, which could be manifested in other ways; it was purely and simply the fact of the harmonies being in tune, which was an agreeable novelty to the ear.

On the pianoforte, where the sounds were not long sustained, the errors of the temperament were not so offensive, but on instruments with sustained tones, such as the organ and harmonium, the defects were much more prominent. In olden times musicians had more sensitive ears, and organs were tuned (as Mr. Ellis had stated in regard to Handel's organ) on a temperament which put the principal keys in good tune, and threw the defects into keys seldom or never used on an organ in those days. But since that time, as modern music, and especially what the Germans called *Fingerfertigkeit*, had increased in popular favour, organists had made up their minds to play in all sorts of remote keys, and had demanded that the organ builders should favour this by applying the equal temperament. For show organs this course might be defended, but for church organs, where nothing was required but the use of the simplest keys, it was perfectly indefensible, as it was spoiling the tone of the organ for its ordinary use, for the sake of a purely imaginary want. The organ was half a century ago a sweet-sounding instrument; now it was a harsh, offensive one, which made attendance at church a penance to persons with musically sensitive ears. A curious proof occurred a few years ago as to the mischief the equal temperament did to the tone of an organ. Dr. Pole had to superintend the construction of two organs of tolerable size: in one he was obliged to give way to popular prejudice by having it tuned equally; in the other he pleased himself by adopting the old tuning; and although the instruments were precisely alike in other respects, and made by the same builder, the latter acquired the reputation of a peculiarly sweet-toned organ, while the former was considered a harsh tone.

It was time something was done to correct the evil, but there had been difficulties both theoretical and practical. Theoretically it had been difficult to determine what should be the exact pitch and number of the notes to be used, but he conceived Mr. Ellis had now exhausted that subject, and that for the future no person who wished to carry out plans of just intonation would find difficulty in selecting from Mr. Ellis's data, exactly such *ducdenes*, or series of notes, as would answer his purpose. There were still difficulties in practice, for as it was certain that more notes than twelve must be used, the problem how to enable the player to arrange them easily was not an easy one. In this particular, however, progress was being made; Mr. Ellis had pointed out several important simplifications, and Dr. Pole especially looked on the harmonium with shifting tones now exhibited as a promising invention. It was pleasant to hope there was some practical possibility of getting music in tune.

The continued discussion of the subject of just intonation was very desirable, for the reason that practical musicians, probably from a feeling of hopelessness as to getting anything better, were beginning to consider equal temperament as a necessary evil, and to look upon its harshness with indifference. Indeed, it was to be feared that the ears of musicians were becoming actually deteriorated in sensitiveness to errors of intonation. In our best orchestras, for example, although the strings might play in tune (for our orchestral violinists had no superiors in the world), yet the wind instruments were often false; and our conductors, even the best of them, seemed callous to the cacophony. He might remark here that the efforts at producing just intonation had been hitherto confined to instruments with the pianoforte keyboard, but there was a wide field open for the improvement in this respect of orchestral wind instruments, in regard to the just intonation of which absolutely nothing had yet been done. The utmost wind instrument makers had aimed at was to make them play correctly on equal temperament; he was not aware that anybody had thought it worth while to make enharmonic distinctions in their scale.

On all these accounts Mr. Ellis's labours to improve the general knowledge of the subject were most valuable, and earned for him the gratitude of all true lovers of music.

THE TREE-ALOES OF SOUTH AFRICA

THE flora of Southern Africa is extremely remarkable, not merely for the number of its species and their generally very restricted range, but also for the frequent singularity of their aspect and manner of growth. In

each of these particulars the genus *Aloe* is no exception to the general rule. Many of the species are well known in cultivation, but all agree in having fleshy elongated evergreen leaves, and thick erect spikes of yellow or red flowers. Medicinally, many species (and possibly all might be) are of importance as yielding a well-known bitter drug, which is simply the juice exuded from the leaves when cut, and boiled down to a solid consistence.

The species of *Aloe* are probably only really indigenous in Southern and Eastern Africa. *A. vulgaris* is now, however, found widely distributed along the Mediterranean and in the East and West Indies, where it is cultivated as the source of the Barbados and Curaçoa aloes.* *A. indica*, Royle, is doubtless a slight variety. Dr. Stewart mentions it as being occasionally cultivated throughout the Punjâb, and says that the pulp of the leaves is eaten by poor people and in famines.† According to the same writer, the Aloe mentioned by Masson in the Punjâb is a palm (*Chamærops Ritchiana*).‡ *A. littoralis*, König, found at Cape Comorin, is believed to be a form of *A. vulgaris*, altered by the circumstances of its situation. The habit of growth in the genus varies considerably. Mrs. Barber, a well-known South African naturalist, gives the following account of the part they play in the physiognomy of the native vegetation :—

"The genus *Aloe*, Linn., has a wide range in this country, its numerous species occurring in all rocky localities throughout the land ; wherever rocks are found there are the Aloes also, cropping out (if I may be allowed the expression) with the geological formations of the country, as if they formed a part of them, decorating each knoll and cliff with their gay blossoms in great profusion and variety, from the gigantic Aloe of the Transkeian territory, which attains the height of sixty feet, and the tall, graceful, wood Aloes, to the sturdy, stout-built Aloe of the cliff, and the minute lizard-tail-like species that are scattered among the grass, each filling its peculiar *locale*

FIG. 1.—*Aloe dichotoma*, Linn., from Namaqualand.

FIG. 2.—*Aloe Barbera*, Dyer, rom Kaffraria.

to complete the character of the landscape, and to render it truly South African in appearance."§

It may be well to mention that the true Aloes of the Old World have nothing whatever to do with the so-called "American Aloe." This is a species of *Agave*, a genus indigenous to Mexico and South America. The habit of the two genera is in many respects curiously similar, and they afford a striking instance of "homoplasy"—of the assumption by organisms essentially differing in themselves, of externally similar forms, when exposed to similar external conditions. *Aloe* commonly flowers laterally, and the growth of its main axis is therefore not arrested ; *Agave*, as is generally known, flowers from its central bud, and consequently dies afterwards. *Aloe* is Liliaceous, with a superior ovary ; *Agave* is Amaryllidaceous, with an inferior one. But *Aloe*, as we have seen, has passed to the New World, and *Agave* is quite as much at home now in the Old World as its representatives are.

One is at first sight hardly prepared to hear of Aloes assuming the dimensions of trees. That they do so is, however, quite certain, though our knowledge of the arborescent species was, till quite lately, extremely imperfect, and is, indeed, still far from complete. I collected together all the material I could get access to in a paper published in the *Gardener's Chronicle* for May 2 of this year. My present object, besides that of calling the attention of the readers of NATURE to these very remarkable plants, is to correct a rather important error into which I find that I have fallen respecting them.

In point of fact, it is now pretty clear that the west and east coasts of South Africa each possess one endemic Tree-Aloe. That of the west, where it is distributed from Walvisch Bay to Clanwilliam, is *Aloe dichotoma*, Linn.

* Flückiger and Hanbury's "Pharmacographia," p. 616.
† "Punjâb Plants," p. 232. ‡ Loc. cit., p. 242.
§ Journ. Roy. Hort. Soc. New Series, vol. ii. p. 80.

well described in Paterson's "Travels in Africa" (1789), but otherwise very little known. The present Governor of the Cape, Sir Henry Barkly, has made great exertions to procure plants for Kew, and two have now arrived in this country, the largest being 8 ft. in height, but there is some doubt whether either will eventually survive the voyage.

Aloe dichotoma appears to attain a height of about 30 ft., with a girt of about 12 ft.* Fig. 1 is from a photograph by Mr. Chapman, and is reproduced from the *Gardener's Chronicle*. Young plants of the Aloe from Kaffraria, alluded to above by Mrs. Barber, are now in cultivation at Kew. Finding that the name by which it was known belonged to another species, *A. Zeyheri*, and that it was undescribed, I renamed it *Aloe Barberæ*, in honour of Mrs. Barber, who first sent cuttings of it to this country. Fig. 2 (which is also borrowed from the *Gardener's Chronicle*) is a copy of a rough sketch sent to this country by the Rev. R. Baur, a Moravian missionary, at present

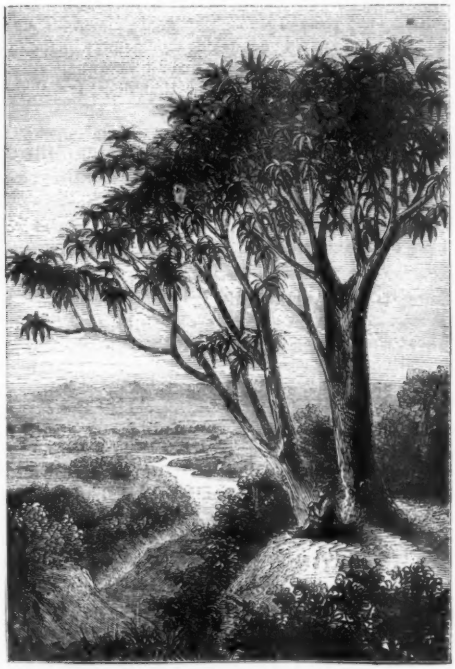


FIG. 3.—*Aloe Barberæ*, Dyer, from Natal.

resident in Kaffraria. He speaks of it as growing in the forests to the height of 30 ft., with a girt three feet above the ground of about 16 ft. Its dimensions are therefore about the same as those of *Aloe dichotoma*. In Mr. Baur's sketch the seed-vessels are represented, and he feared that he had made them proportionately too large.

An arborescent Aloe also exists in Natal. An account of this from Mr. Baines, the well-known African traveller, with a sketch of the spot where the plants occurred, was sent to Dr. Hooker with a living branch during last year. It was the subject of a communication made to the British Association at Bradford.† The appearance of the branch of the Natal plant was so different from that of the Kaffrarian, that I ventured to characterise it as a new species under the name of *Aloe Bainesii*, on the ground that the leaves were longer, not glaucous, and not so completely crowded into a terminal tuft. The fact of the leaves being crowded into a terminal rosette, or spaced down the stem, is found to afford a character of even sectional value among the species. I was therefore rather astonished to find that when the Natal plant had fairly established itself, its rosette of leaves began to grow out. It is apparently only in old plants that the leaves are crowded into rosettes. I do not now doubt that the Kew plant of the Natal Aloe will eventually assume quite the same appearance as plants of the Kaffrarian one, with which I am now disposed to believe it to be identical. The name *A. Bainesii* must therefore be merged as a synonym in *A. Barberæ*. The only remaining discrepancy is with respect to the flowers. Mr. Baines believes that those of his plant were orange or scarlet. Those of the Kaffrarian plant (ample specimens of which I have recently received through the kindness of Sir Henry Barkly) appear, from a sketch made by Lady Barkly, to be rose, passing into flesh-colour.

The sketch of *A. Barberæ* from Natal (Fig. 3) is from a drawing by Mr. Sanderson, of D'Urban.

The stems of these Aloes must necessarily increase "exogenously" in diameter. This, no doubt, takes place in the same way as in the well-known Dragon Tree (*Dracæna Draco*).

W. T. THISELTON DYER

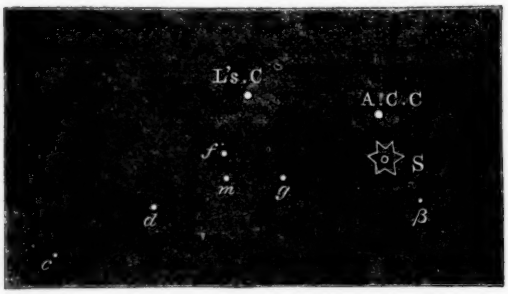
* By an unfortunate misprint in the *Gardener's Chronicle* (copied by Flückiger and Hanbury, *loc. cit.*), 30 ft. is given as the greatest girt.

† See *Journal of Botany*, 1873, p. 348. The sketch is reproduced in the *Gardener's Chronicle*, loc. cit.

TRANSACTIONS AND PROCEEDINGS OF THE ROYAL SOCIETY OF VICTORIA

WE have received the Proceedings of the Royal Society of Victoria for the years 1870, 1871, and 1872, the issue of which has been delayed by the withdrawal of the Government grant in 1868, but through the liberality of the present Government we are glad to hear that the financial state of the Society enables the present report to be printed. We have read with great pleasure the addresses of the president, Mr. Ellery, showing that scientific knowledge is gaining ground fast in Victoria. Mr. Ellery tells us of the work at the Observatory, and that the positions of 38,305 stars have been established up to 1870. In 1868 the great reflector of 4 ft. diameter was mounted, and Mr. Ellery says that although his hopes were not fully realised, the telescope, if it does not excel, equals every other of its size. Mr. Le Sueur appears to have attacked η Argus and its surrounding nebula as early as possible, and in February 1870 he informs the Society that the spectrum of η is crossed by bright lines corresponding to *C D E F* and one beyond *F*, probably *Hy* : the principal line of nitrogen was also seen. He therefore concludes that hydrogen, nitrogen, sodium, and magnesium are indicated. No dark lines seem to have been seen with certainty, although they were suspected. Mr. Le Sueur says : "We seem driven to the conclusion that the star consists of a solid nucleus, a gaseous envelope cooler than the nucleus producing the dark lines, and a second envelope hotter than the nucleus accounting for the bright ones." We hope we shall not be quite driven to this conclusion of a solid nucleus, which seems highly improbable. A large influx of hot hydrogen or nitrogen from the nebula or other source might be sufficient to reverse the dark lines, and as this would heat the original photosphere more intensely its absorption would be reduced, accounting for the reduction in intensity of the black lines. In January 1874 we find that Mr. Macgeorge examined this star and found no bright lines, and further, that a distinct nebulosity surrounded the star, which in December 1869 appeared, according to Le Sueur, on a black background. Mr. Macgeorge furnishes several drawings of the nebula surrounding η which show a vast change in the shape of the mass. In 1838 η was involved in dense nebula, while

in 1869 it was seen on a bare sky. The further drawings by Mr. Ellery and Mr. Le Sueur are scarcely recognisable as being made from the same nebula, so vast appears the changes; in one instance the difference between two drawings shows a motion of the gas, if motion it be, of 6,000,000,000 miles a month. We have known comets' tails or jets to have a motion comparable to this—so perhaps some similar cause is acting here. Mr. L. Sueur appears to have carefully examined the spectrum of Jupiter with the Melbourne reflector, but with no very decisive results, the absorption-lines appearing constant across the slits, which leads him to infer that the light from the different parts of the visible surfaces had passed through not widely unequal thicknesses of atmosphere, or that the least thickness was sufficient to produce a maximum absorption. Mr. Ellery has been trying paper paraffined, instead of waxed, for photographing the continuous records of magnetic and other phenomena, thereby shortening the sensitising and developing by more than an hour; but he has found that by using plain paper some four hours are saved. The process he uses is a slight modification of Crooke's. A large number of enhydros or water-stones were found at Beechworth in 1864. On the granite rock near Beechworth



is a Silurian outlier of sandstone, intersected with veins of blue quartz, and in the widening of these veins the stones appear. They lie in nests lined with scales of chalcedony and fine clay. Mr. Dunn describes the enhydros as consisting of chalcedony, irregular in form, bounded by true planes varying in colour, from yellow and opaque to quite colourless and transparent, and their size from 5 in. diameter to the size of a split pea. The contents of the stones appear from analysis by Mr. Foord to consist of water slightly mineralised with chloride and sulphate of sodium, magnesium, calcium, and a soluble form of silicic acid. Mr. Macgeorge has been at work observing the small stars near Sirius. We copy his diagram of these stars, all of which require large optical means to render them visible: the position of Alvan Clarke's comet in January 1865 is given as 77° 63′, and that of Lassell's companion 163° 89′. We are glad to see papers on the colonial timber trees, discussing the suitability of certain trees to the climate. Amongst our English trees that thrive there, are the oak, elm, ash, walnut, willow; the larch, pines, and poplars, however, seem unsuited. The red and blue gums and the blackwood seem to be amongst the most useful indigenous trees. The poisoning of water and air in Melbourne has also been occupying the attention of the Society, and Mr. Gibbons furnishes the report with several well-executed micro-photographs of the water from sewage, and drinking water from the Yan-Zean reservoir, in which forms of life appear in abundance. Numerous other papers of interest appear in the report, and we must congratulate the Society on so good a show of research.

G. M. S.

NOTES

THE Anniversary Meeting of the Royal Society was held on Monday last; the list of the new Council we have already given. Owing to the absence of the President from domestic affliction, the chair was occupied by the Secretary, Mr. Spottiswoode. At the dinner in the evening three members of the Government were present—Lords Carnarvon and Salisbury, and Mr. W. Hunt. Lord Carnarvon in his speech gave out "no uncertain sound" as to what he deemed the duty of Government in the matter of endowment of scientific research; he virtually agreed to all the principles which we have so long and so strenuously advocated. We may therefore hope that the money to be devoted to the new Arctic Expedition is only a first instalment of what the Government think is due by the country to the promotion of directly unremunerative research.

THE command of the Arctic Expedition will be offered to one of those officers who acquired a thorough knowledge, in former expeditions, of sledge travelling, and of the true system of bringing men healthy and cheerful through an arctic winter. Thus it is intended that the present undertaking should start with the advantage of all the practical knowledge and all the experience which was accumulated in the searches for Franklin. It will also be composed of the pick of our educated young officers, and will so combine matured experience with dash and vigour. An important position will, we have no doubt, be offered to Commander A. H. Markham, whose qualifications for the post have already been well tested.

THE Oxford Professor of Geology, Mr. Prestwich, will deliver his inaugural lecture at the Museum on Friday, December 11, at 2 P.M.

THE Cambridge Board of Medical Studies have reported to the Vice-Chancellor that they have been engaged during the present term in revising the regulations for proceedings in medicine, and are desirous of recommending some changes. The Board are of opinion that it is expedient for the University to establish examinations and grant certificates of competency in so much of state medicine as is comprised in the functions of the officers of health. The certificate given to successful candidates should testify only to their competent knowledge of what is required for the duties of an officer of health. The Board recommend the following for the subjects of examination:—1. Physics and Chemistry. The principles of chemistry and methods of analysis, with especial reference to analyses (microscopical as well as chemical) of air and water; the Laws of Heat, and the principles of Pneumatics, Hydrostatics, and Hydraulics, with special reference to ventilation, water supply, drainage, construction of dwellings, and sanitary engineering in general. 2. Laws relating to Public Health. 3. Sanitary Statistics. 4. Origin, Propagation, Pathology, and Prevention of Epidemic and Infectious Diseases; effects of overcrowding, vitiated air, impure water, and bad or insufficient food; unhealthy occupations, and the diseases to which they give rise; water supply, and disposal of sewage and refuse; nuisances injurious to health; distribution of diseases within the United Kingdom, and effects of soil, season, and climate. The Vice-Chancellor has convened a meeting of general members of the Senate for to-day, in the Arts School, for the discussion of the report.

IT will be proposed in a Convocation to be held at Oxford on the 9th of December, that a sum not exceeding 100*l.* be placed at the disposal of Dr. Rolleston, Prof. H. J. S. Smith, and the Rev. Hereford B. George, M.A., of New College, for the purpose of purchasing archæological objects relating to Prehistoric periods, to be placed in the University Museum.

THE following telegram is dated Aden, Nov. 28:—"Letters have been received from Lieut. Cameron to the 16th of May.

His party were all well. He had circumnavigated the Tanganyika Lake, and found the effluent south of Speke's Islands, which the natives reported to be Congo, identical with Livingstone's Lualaba. He hopes to reach Jellala Falls and Loanda."

SOUTH Australian papers record with the utmost satisfaction the success of Mr. John Forrest in crossing from the western coast of Australia to the Overland Telegraph, through the very heart of the only extensive region in Australia which remains unexplored. He and his companions travelled nearly 2,000 miles, keeping close to the 26th parallel of south latitude. They left Champion Bay on April 1, and reached the telegraph line on Sept. 27. Much of the territory passed over was of the poorest possible description, and for 600 miles the travellers had to force their way through a spinifex desert scantily supplied with water. They had several times to fight the natives. Mr. Forrest has narrowed down, within very moderate limits, the unexplored territory lying between the settled districts of South and Western Australia. His achievement leaves only the direct and more southern route to Perth to be traversed in order to complete the data requisite for giving to the world a fair general insight into the character of the West Australian Continent.

THE American Academy of Sciences held its half-yearly session at Philadelphia on Nov. 3, 4, and 5 last, when a number of valuable papers were read. We have only space for the titles of the more important :—"Results derived from an examination of the U.S. Weather Maps for 1872—3," by Prof. E. Loomis; "The Composite Nature of the Electric Discharge," by Prof. A. M. Mayer; "The Decay of Crystalline Rocks," by Prof. T. Sterry Hunt; "Geological Survey of Colorado," by Dr. F. V. Hayden. Dr. Hayden exhibited photographs of ruined cities and villages discovered by his party in the cañons leading into the Colorado River and upon the plains in the vicinity, supposed to have been built more than 1,000 years ago by the ancestors of the present Moquis Indians. The important fact established by these discoveries is, that there once existed in what are now the arid plains and savage gorges of South-eastern Colorado a race so far civilised that they built large cities, constructing their houses of well-hewn blocks of stone, with timber floors, well-formed windows and doorways, and smoothly plastered walls, and that they possessed the art of making glazed pottery.—"Nervous System of Limulus," by Mr. A. S. Packard, jun.; "Measuring Minute Changes in Atmospheric Pressure," by Prof. A. M. Mayer; "Effect of Wind on Sound Waves," by Prof. Joseph Henry; "Removal of Ammonia from Illuminating Gas," by Prof. B. Silliman; "Physical Measurement of the Horizontal Pendulum," and "Effect of Magnetism on Iron," by Prof. O. N. Rood; "Palæontological Evidence of the Ages of Strata," by Prof. Theodore Gill.

IF adulteration in England has become one of the arts, it is certain that we are not looked down upon by all nations as being beyond compare in this nefarious practice. A large trade has hitherto existed between Aleppo and England in extract of scammony; but we are told that comparatively little is now exported. "On account of its mixture with other substances," only twenty cases in all, weighing 2,100 lbs., were shipped during the past year, the value of which was 1,680*l.*, and the whole of this came to England. In the previous year, 737 cases were exported, showing that adulteration alone is rapidly driving this article out of the import market, for the roots are produced as abundantly as ever, and are dug up and sent to England, the extract being procured from them in this country. 467 cases, weighing 93,340 lbs., and valued at 362*l.*, were shipped from Aleppo to England in 1873. Considering the bulk and weight of the roots as compared with that of the extract and the consequent increase of the cost of freight, it would seem that this exportation of the roots themselves can scarcely be a profitable trade to the shippers, inasmuch as 467 cases are valued only at 362*l.*, while twenty cases of the extract are worth 1,680*l.*

WE learn from a report on the trade and commerce of Maine U.S., that the quantity of lobster packed in cans in the factories of the coast in 1873 was 1,600,000 lb., mostly in 1 lb. cans. In addition to tins, the same firms packed at their establishments in Nova Scotia over 2,000,000 cans, making the total amount packed by Portland houses in the past year, 3,600,000 cans of lobster. Besides other products which are packed in tins in America, as well for home consumption as for exportation, green maize is one of the most important; 4,000,000 cans of this maize were packed in Maine during the past year. In California a large and increasing trade is carried on in curing or drying fruits, which at one time was done by exposure of the fruits to the air. This, however, has been superseded by the process of desiccating with a blast of hot air. By this means the fruits retain all their freshness of flavour.

THE scarcity of oysters, which is now attracting renewed public attention, is a question which intimately affects a large number of people. The point is quite as important to the public as that of the scarcity of salmon, which was taken up by the Legislature thirteen years ago. Whether, as two rival parties of theorists maintain, the failure is due to natural causes or to over-dredging, the result to the public is the same, and it will only be by some systematic investigation that the doubts will be set at rest. That unfavourable weather should be the sole cause of the scarcity of oysters, for a dozen successive years, is very hard to believe; and though it is only natural that weather should have some effect upon the produce of these bivalves, it is more probable that overdredging is equally if not more to blame. In such a case some restrictions are necessary, and these restrictions can only be enforced by the action of Parliament.

A FEW weeks ago we alluded to the suggestion made by the Government of Newfoundland for the establishment of a close time for seals. We are glad to see that our own Government are also alive to the necessity for some steps being taken to prevent the annual slaughter of thousands of young and immature and breeding seals which takes place at present. The first step will be to take the opinions of the owners of sealing vessels on the advisability of such a course, and with this object we understand that the officials of the Board of Trade have already arranged to visit the principal sealing ports of Scotland.

THE *Daily News* of Tuesday has a letter from its correspondent with the Egyptian Transit Expedition, dated Thebes, Nov. 9, from which we learn that the astronomers have located themselves on an island to the south of Karnak. So far everything has gone well, and if the weather only prove favourable the work is likely to be successful. To the east the horizon is unobstructed by anything except a distant range of hills, which cannot measure more than one angular degree.

A CORRESPONDENT,¶ "H. B. P.," writes to correct Dr. Petermann's statement quoted in last week's article (p. 61) that the Ashantee War "cost nine millions sterling." "The utmost cost of the Ashantee expedition," our correspondent states, and he writes from the War Department, Woolwich, "was seventeen or eighteen hundred thousand pounds, and this includes stores innumerable, which were returned unshipped, and which have depreciated but little in value." This, however, in no way invalidates the force of Dr. Petermann's statement so far as concerns the purpose for which we adduced it.

MR. J. V. JONES, of University College, London, has been elected to the Brackenbury Natural Science Scholarship in connection with Balliol College, Oxford.

THE observations of the November swarm of falling stars at the several French stations had no result. It seems pretty certain that the phenomenon is now at its lowest ebb of brilliancy.

M. CHEVREUL, the director of the Paris Museum, has resigned his office owing to difficulties in the nomination of a professor. The administration and the professors have come to the conclusion that the appointment must be postponed for a year, and a *suppléant* will deliver the lectures.

THE first number of a new monthly illustrated periodical, largely devoted to science, has just appeared in Paris. It is entitled, *Revue Illustrée des Lettres, Sciences, Arts, et Industries dans les Deux Mondes.*

Annales Telegraphiques, a periodical issued by the French administration, but in abeyance for the last eight years, has again reappeared.

M. MARTIN, a French telegraphic engineer, has invented an engine for recording votes. The contrivance has been designed on the principle of the *sonnettes électriques*, and is exhibited in a shop in the Place Dauphine. The peculiarity is that the votes are registered and their total reckoned automatically. The invention is attracting public notice, as it is expected that the Versailles representatives will have an immense number of votes to register during the next session.

MR. ERNEST INGERSOLL, of Boston, U.S., who accompanied the party of Dr. Hayden during the past summer, as zoologist, has returned with a large quantity of specimens of natural history, which he is engaged in working up for publication. An important feature of this series consists in a very extensive collection of land and freshwater shells, a branch which has been too much neglected lately by explorers, to whom recent and fossil vertebrates have had greater attractions. Mr. Ingersoll was greatly surprised at the number and character of the molluscan forms secured in Colorado, as also their strange distribution and stations, and is confident that the facts which he has to present will be considered extremely interesting to conchologists.

AMONG the gaps that have remained unfilled in the series of reports of the Wilkes Expedition has been that on the plants collected by the party, partly in consequence of the failure of the U.S. Congress to make the necessary appropriations, and partly on account of the death of Dr. Torrey, who had charge of the phenogamous portion. This volume, however, has lately appeared, Dr. Gray having undertaken the work of Dr. Torrey after his death. That part relating to the cryptogamous plants (consisting of the mosses) had been already published in several portions—that on the mosses as prepared by Mr. W. S. Sullivant, that of the lichens by Prof. Tuckerman, and that on the algæ by Professors Bailey and Harvey; the fungi by the late Dr. Curtis and Mr. Berkeley. The volume is an imperial quarto of 420 pages of letter-press, and contains twenty-nine plates. Of this only twenty copies are on sale, to be had of Westermann and Co., New York, and at the Herbarium of Harvard University.

THE Council of the Society of Arts have arranged with Prof. McLeod, of the India Engineering College, Cooper's Hill, to deliver two lectures (on dates to be hereafter determined) during the Christmas holidays. The subject will be "The Work and Food of the Iron Horse."

A SEVERE earthquake shock was felt in Chili shortly after midnight on Sept. 26. It extended as far north as Copiapo, and south as far as Talca, and was the heaviest shock experienced since the memorable one of July 7 last year. Valparaiso, Santiago, and intermediate country were almost on the focus of the intensity of the shock. The earthquake travelled from east to west. The temperature immediately rose two degrees and six-tenths. The night was beautifully clear. Several slight tremors were felt during the ensuing week.

THE Hastings and St. Leonards Philosophical and Historical Society, which has entered on the seventeenth year of its work, is on the whole in a healthy condition. A number of the members have undertaken to investigate the science of the neighbourhood in connection with botany, zoology, archæology, geology, meteorology, &c., so that we may expect by and by some results of substantial value.

IT is gratifying to hear that an attempt is being made to create an interest in science in North London. A series of lectures on scientific subjects are being given in the Athenæum, Camden Road, at a very moderate price, and we hope the result will be the formation of a North London Scientific Society and Field Club, somewhat after the model of the one recently started in West London. These North London lectures we shall notify in our "Diary."

A RECENT number of the *Australian Sketcher* contains a very interesting account of the great Melbourne telescope, with which so much good work has already been done by Mr. Ellery and his staff; a series of well-executed illustrations accompany the paper. It is, as the article justly concludes, to the credit of the colony that amidst its prevalent utilitarianism it remembered and recognised the claims of science to the degree implied in the purchase and support of so noble an instrument. The telescope cost about 5,000*l.*, in addition to the sum of 1,500*l.* for the house.

WE are glad to see that Mr. W. G. Valentin's "Course of Qualitative Chemical Analysis" (Churchill) has reached a third edition.

DR. WEINHOLD'S excellent "Vorschule der Experimentalphysik," which we noticed in vol. iv. p. 158, has reached a second edition, in which the author has brought his work up to time.

"BEAUTY in Common Things" is the title of a very pretty quarto volume published by the Society for Promoting Christian Knowledge. It consists of twelve chromolithographed drawings from nature by Mrs. J. W. Whymper, with descriptive text by the author of "Life Underground." The drawings are all of the most common plants, such as the Bramble, the Wild Strawberry, Furze Blossom, Blackthorn, Mushrooms, &c.; but while perfectly faithful to nature, the arrangement and execution are so artistic as to afford genuine pleasure. The text is pleasant and informing, and altogether the book is a very beautiful Christmas present, and likely to give children into whose hands it may fall, a taste for the study of nature.

WE have received the fifth edition (dated 1875) of Dr. J. H. Bennett's very interesting book, "Winter and Spring on the Shores of the Mediterranean" (Churchill). We recommend it to those in search of a genial winter home.

FROM Liverpool comes a carefully compiled "Synopsis of an Arrangement of Invertebrate Animals in the Free Public Museum of Liverpool," by the Rev. H. H. Higgins, M.A. Prefixed is an introduction the substance of which appeared in two articles by Mr. Higgins, in NATURE, vol. iii. pp. 202 and 481.

THE Geological, Botanical, and Natural History Section of the Catalogue of the Leeds Public Library contains the names of many valuable works of reference. Some of our readers may be glad to know that access can be had at all times to any of the works mentioned in the catalogue.

THE additions to the Zoological Society's Gardens during the past week include two Great Kangaroos (*Macropus giganteus*), from New South Wales, presented by Mr. A. Nicol; two Common Boas (*Boa constrictor*), two Agoutis (*Dasyprocta?*), from St. Lucia, presented by Mr. Neville Holland; a Virginian Deer (*Cervus virginianus*), from South America, presented by Capt. E. H. Cobbett; a Gazelle (*Gazella dorcas*), from Egypt, presented by Miss Lancaster; a Common Peafowl (*Pavo cristatus*), from India, presented by the Hon. A. S. G. Canning; a Vervet Monkey (*Cercopithecus lalandii*), from South Africa; and a Sun Badger (*Helictis moschata*), from East Asia, new to the collection.

THE "CHALLENGER" EXPEDITION*

DURING our southern cruise the sounding-lead brought up five absolutely distinct kinds of sea-bottom, without taking into account the rock and detritus of shallow soundings in the neighbourhood of land. Our first two soundings in 98 and 150 fathoms on the 17th and 18th of December were in the region of the Agulhas current. These soundings would have been naturally logged "greenish sand," but on examining the sandy particles with the microscope, they were found to consist almost without exception of the casts of foraminifera in one of the complex silicates of alumina, iron, and potash, probably some form of glauconite. The genera principally represented by these casts were Miliola, Biloculina, Uvigerina, Planorbulina, Rotalia, Textularia, Bulimina, and Nummulina; Globigerina, Orbulina, and Pulvinulina were present, but not nearly in so great abundance. There were very few foraminifera on the surface of the sea at the time. This kind of bottom has been met with once or twice before; but it is evidently exceptional, depending upon some peculiar local conditions.

From the Cape, as far south as our station in lat. 46° 16′, we found no depth greater than 1,900 fathoms, and the bottom was in every case "Globigerina ooze;" that is to say, it consisted of little else than the shells of Globigerina, whole, or more or less broken up, with a small proportion of the shells of Pulvinulina and of Orbulina, and the spines and tests of radiolarians and fragments of the spicules of sponges.

Mr. Murray has been paying the closest attention since the time of our departure to the question of the origin of this calcareous formation, which is of so great interest and importance on account of its anomalous character and its enormous extension. Very early in the voyage he formed the opinion that all the organisms entering into its composition at the bottom are dead, and that all of them live abundantly at the surface and at intermediate depths over the Globigerina-ooze area, the ooze being formed by the subsiding of these shells to the bottom after death.

This is by no means a new view. It was advocated by the late Prof. Bailey, of West Point, shortly after the discovery, by means of Lieut. Brooke's ingenious sounding instrument, that such a formation had a wide extension in the Atlantic. Johannes Müller, Count Pourtales, Krohn, and Max-Schultze, observed Globigerina and Orbulina living on the surface; and Ernst Hæckel, in his important work upon the Radiolaria, remarks that "we often find upon, and carried along by the floating pieces of seaweed which are so frequently met with in all seas, foraminifera as well as other animal forms which habitually live at the bottom." However, setting aside these accidental instances, certain foraminifera, particularly in their younger stages, occur in some localities so constantly and in such numbers, floating on the surface of the sea, that the suspicion seems justifiable that they possess, at all events at a certain period of their existence, a pelagic mode of life, differing in this respect from most of the remainder of their class. Thus Müller often found in the contents of the surface-net off the coast of France the young of Rotalia, but more particularly Globigerinæ and Orbulinæ, the two latter frequently covered with fine calcareous tubes, prolongations of the borders of the fine pores through which the pseudogradia protrude through the shell. I took similar Globigerinæ and Orbulinæ almost daily in a fine net at Messina, often in great numbers, particularly in February. Often the shell was covered with a whole forest of extremely long and delicate calcareous tubes projecting from all sides, and probably contributing essentially to enable these little animals to float below the surface of the water by increasing their surface greatly, and consequently their friction against the water, and rendering it more difficult for them to sink."* In 1865 and 1866 two papers were read by Major Owen, F.L.S., before the Linnean Society, "On the Surface Fauna of Mid-Ocean." In these communications the author stated that he had taken foraminifera of the genera Globigerina and Pulvinulina, living, in the tow-net on the surface, at many stations in the Indian and Atlantic Oceans. He described the special forms of these genera which were most common, and gave an interesting account of their habits, proposing for a family which should include Globigerina, with Orbulina as a sub-genus, and Pulvinulina, the name Colymbitæ, from the circumstance that, like the Radiolaria, these foraminifera are found on the surface after sunset, "diving" to some depth beneath it during the heat of the day. Our colleague, Mr. Gwyn Jeffreys, chiefly on the strength of Major Owen's papers, maintained that certain foraminifera were surface animals, in opposition to Dr. Carpenter and myself.† I had formed and expressed a very strong opinion on the matter. It seemed to me that the evidence was conclusive that the foraminifera which formed the Globigerina ooze lived on the bottom, and that the occurrence of individuals on the surface was accidental and exceptional; but after going into the thing carefully, and considering the mass of evidence which has been accumulated by Mr. Murray, I now admit that I was in error; and I agree with him that it may be taken as proved that all the materials of such deposits, with the exception, of course, of the remains of animals which we now know to live at the bottom at all depths, which occur in the deposit as foreign bodies, are derived from the surface.

Mr. Murray has combined with a careful examination of the soundings a constant use of the tow-net, usually at the surface, but also at depths of from ten to one hundred fathoms; and he finds the closest relation to exist between the surface fauna of any particular locality and the deposit which is taking place at the bottom. In all seas, from the equator to the polar ice, the tow-net contains Globigerinæ. They are more abundant and of a larger size in warmer seas; several varieties, attaining a large size and presenting marked varietal characters, are found in the intertropical area of the Atlantic. In the latitude of Kerguelen they are less numerous and smaller, while further south they are still more dwarfed, and only one variety, the typical *Globigerina bulloides*, is represented. The living Globigerinæ from the tow-net are singularly different in appearance from the dead shells we find at the bottom. The shell is clear and transparent, and each of the pores which penetrate it is surrounded by a raised crest, the crest round adjacent pores coalescing into a roughly hexagonal network, so that the pores appears to lie at the bottom of a hexagonal pit. At each angle of this hexagon the crest gives off a delicate flexible calcareous spine, which is sometimes four or five times the diameter of the shell in length. The spines radiate symmetrically from the direction of the centre of each chamber of the shell, and the sheaves of long transparent needles crossing one another in different directions have a very beautiful effect. The smaller inner chambers of the shell are entirely filled with an orange-yellow granular sarcode; and the large terminal chamber usually contains only a small irregular mass, or two or three small masses run together, of the same yellow sarcode stuck against one side, the remainder of the chamber being empty. No definite arrangement and no approach to structure was observed in the sarcode, and no differentiation, with the exception of round bright-yellow oil-globules, very much like those found in some of the radiolarians, which are scattered apparently irregularly in the sarcode. We never have been able to detect in any of the large number of Globigerinæ which we have examined the least trace of pseudopodia, or any extension in any form of the sarcode beyond the shell.

Major Owen (*op. cit.*) has referred the Globigerina with spines to a distinct species, under the name of *G. hirsuta*. I am inclined rather to believe that all Globigerinæ are to a greater or

* "Preliminary Notes on the Nature of the Sea-bottom procured by the Soundings of H.M.S. *Challenger* during her Cruise in the Southern Sea in the early part of the year 1874." By Prof. C. Wyville Thomson, F.R.S., director of the Civilian Scientific Staff on board. Read before the Royal Society, Nov. 26, 1874.

* "Die Radiolarien." Eine Monographie von Dr. Ernst Hæckel. Berlin, 1862, pp. 165, 167

† Mr. Jeffreys desires to record his dissent from this conclusion, since (from his own observations, as well as those of Major Owen and Lieut. Palmer) he believes Globigerina to be exclusively an oceanic foraminifera inhabiting only the superficial stratum of the sea. (Preliminary Report of the Scientific Exploration of the Deep Sea, "Proceedings of the Royal Society," No. 121, page 443.)

less degree spiny when the shell has attained its full development. In specimens taken with the tow-net the spines are very usually absent; but that is probably on account of their extreme tenuity; they are broken off by the slightest touch. In fresh examples from the surface, the dots indicating the origin of the lost spines may almost always be made out with a high power. There are never spines on the Globigerinæ from the bottom, even in the shallowest water. Two or three very marked varieties of Globigerina occur; but I certainly do not think that the characters of any of them can be regarded as of specific value.

There is still a good deal of obscurity about the nature of *Orbulina universa*, an organism which occurs in some places in large proportion in the Globigerina ooze. The shell of Orbulina is spherical, usually about ·5 millimetre in diameter, but it is found of all smaller sizes. The texture of the mature shell resembles closely that of Globigerina, but it differs in some important particulars. The pores are markedly of two different sizes, the larger about four times the area of the smaller. The larger pores are the less numerous; they are scattered over the surface of the shell without any appearance of regularity; the smaller pores occupy the spaces between the larger. The crests between the pores are much less regular in Orbulina than they are in Globigerina; and the spines, which are of great length and extreme tenuity, seem rather to arise abruptly from the top of scattered papillæ than to mark the intersections of the crest. This origin of the spines from the papillæ can be well seen with a moderate power on the periphery of the sphere. The spines are hollow and flexible; they naturally radiate regularly from the direction of the centre of the sphere; but in specimens which have been placed under the microscope with the greatest care they are usually entangled together in twisted bundles. They are so fragile that the weight of the shell itself, rolling about with the motion of the ship, is usually sufficient to break off the whole of the spines and leave the papillæ only projecting from its surface in the course of a few minutes. In some examples, either those in process of development, or a series showing a varietal divergence from the ordinary type, the shell is very thin and almost perfectly smooth, with neither papillæ nor spines, nor any visible structure, except the two classes of pores, which are constant.

The chamber of Orbulina is often almost empty; even in the case of examples from the surface, which appears from the freshness and transparency of the shell to be living, it is never full of sarcode; but it frequently contains a small quantity of yellow sarcode stuck against one side, as in the last chamber of Globigerina. Sometimes, but by no means constantly, within the chamber of Orbulina there is a little chain of three or four small chambers singularly resembling in form, in proportion, and in sculpture, a small Globigerina; and sometimes, but again by no means constantly, spines are developed on the surface of the calcareous walls of these inner chambers, like those on the test of Globigerina. The spines radiate from the position of the centre of the chambers and abut against the insides of the wall of the Orbulina In a few cases the inner chambers have been observed apparently arising within or among the sarcode adhering to the wall of the Orbulina.

Major Owen regards Orbulina as a distinct organism, nearly allied to Globigerina, but differing so far from it as to justify its separation into a special subgenus. He considers the small inner chamber of Orbulina as representing the smaller chamber of Globigerina, and the outer wall as the equivalent of the large outer chamber of Globigerina developed in this form as an investing chamber. Count Pourtales, Max-Schultze, and Krohn, on the other hand, believe, on account of the close resemblance in structure between the two shells, their constant association, and the undoubted fact that an object closely resembling a young Globigerina is often found within Orbulina, that the latter is simply a special reproductive chamber budded from the former, and capable of existing independently. I am rather inclined to the latter view, although I think much careful observation is still required to substantiate it; and some even of our own observations would seem to tell somewhat in the opposite direction. Although Orbulina and Globigerina are very usually associated, in different localities, they are so in different proportions; and in the icy sea to the south of Kerguelen, although Globigerina was constantly taken in the surface-net, not a single Orbulina was detected. Like Globigerina, Orbulina is most fully developed and most abundant in the warmer seas.

Associated with these forms, and, like them, living on the surface and dead, and with their shells in various stages of decay at the bottom, there are two very marked species or varieties of Pulvinulina, *P. menardii*, and *P. micheliniana*. The general structure of Pulvinulina resembles that of Globigerina. The shell consists of a congeries of from five to eight chambers arranged in an irregular spiral. As in Globigerina, the last chamber is the largest; the inner smaller chambers are usually filled with yellow sarcode; and as in Globigerina, the last chamber is frequently nearly empty, a small irregular mass of sarcode only occupying a part of the cavity. The walls of the chambers are closely and minutely perforated. The external surface of the wall is nearly smooth, and no trace of a spine has ever been detected. *Pulvinulina menardii* has a large discoidal depressed shell, in diameter consisting of a series of flat chambers overlapping one another, like a number of coins laid down somewhat irregularly, but generally in a spiral: each chamber is bordered by a distinct somewhat thickened solid rim of definite width. On the lower surface of the shell the intervals between the chambers are indicated by deep grooves. The large irregular opening of the final chamber is protected by a crescentic lip, which in some specimens bears a fringe of spine-like papillæ. This form is almost confined to the warmer seas. It is very abundant on the surface, and still more so during the day, at a depth of ten to twenty fathoms in the Mid-Atlantic; and it enters into the composition of the very characteristic Globigerina ooze of the "Dolphine Rise" in almost as large proportions as Globigerina. *Pulvinulina micheliniana* is a smaller variety; the upper surface of the shell is flattened as in *P. menardii*, but the chambers are conical and prolonged downwards, so that the shell is deeper and somewhat turbinate. The two species usually occur together; but *P. micheliniana* has apparently a much wider distribution than *P. menardii*, in which the former was limited to the region of the trade-winds and the equatorial drift-current, and was found rarely, if at all, to the south of the Agulhas current; the latter accompanied us southward as far as Kerguelen Land. Both forms of Pulvinulina, however, are more restricted than Globigerina, for even *P. micheliniana* became scarce after leaving the Cape, and the wonderfully pure calcareous formation in the neighbourhood of Prince Edward Island and the Crozets consists almost solely of *Globigerina bulloides;* and neither species of Pulvinulina occurred to the south of Kerguelen Land.

Over a very large part of the "Globigerina-ooze" area, and especially in those intertropical regions in which the formation is most characteristically developed, although the great bulk of the ooze is made up of entire shells and fragments of shells of the above-described foraminifera, besides these there is frequently a considerable proportion (amounting in some cases to about twenty per cent.) of fine granular matter, which fills the shells and the interstices between them, and forms a kind of matrix or cement. This granular substance is, like the shells, calcareous, disappearing in weak acid to a small insoluble residue: with a low microscopic power it appears amorphous, and it is likely to be regarded at first sight as a paste made up of the ultimate calcareous particles of the disintegrated shells, but under a higher power it is found to consist almost entirely of "coccoliths" and "rhabdoliths." I need scarcely enter here into a detailed description of these singular bodies, which have already been carefully studied by Huxley, Sorby, Gümbel, Carter, Oscar Schmidt, Wallich, and others. I need only state that I believe our observations have placed it beyond a doubt that the "coccoliths" are the separated elements of a peculiar calcareous armature which covers certain spherical bodies (the "coccospheres" of Dr. Wallich.) The rhabdoliths are the like elements of the armature of extremely beautiful little bodies, which have been first observed by Mr. Murray, and naturally called by him "rhabdospheres. Coccospheres and rhabdospheres live abundantly on the surface, especially in warmer seas. If a bucket of water be allowed to stand over night with a few pieces of thread in it, on examining the threads carefully many examples may usually be found attached to them; but Mr. Murray has found an unfailing supply of all forms in the stomachs of Salpæ.

What these coccospheres and rhabdospheres are we are not yet in a position to say with certainty; but our strong impression is that they are either algæ of a peculiar form, or the reproductive gemmules, or the sporangia of some minute organism, probably an alga, in which latter case the coccoliths and rhabdoliths might be regarded as representing in position and function the "amphidisci" on the surface of the gemmules of Spongilla, or the spiny facets on the zygospores of many of the Desmideæ. There are many forms of coccoliths and rhabdoliths, and many of these are

so distinct that they evidently indicate diffe rent species. Mr. Murray believes, however, that only one form is met with on one sphere; and that in order to produce the num erous forms figured by Hæckel and Oscar Schmidt, all of which, and many additional varieties, he has observed, the spheres must vary in age and development, or in kind. Their constant presence in the surface-net, in surface-water drawn in a bucket, and in the stomachs of surface animals, sufficiently prove that, like the ooze-forming foraminiferes, the coccoliths and rhabdoliths, which enter so largely into the composition of the recent deep-sea calcareous formations, live on the surface and at intermediate depths, and sink to the bottom after death. Coccospheres and rhabdospheres have a very wide but not an unlimited distribution. From the Cape of Good Hope they rapidly decreased in number on the surface, and at the bottom as we progressed southwards. The proportion of their remains in the Globigerina ooze near the Crozets and Prince Edward Island was comparatively small; and to this circumstance the extreme clearness and the unusual appearance of being composed of Globigerinæ alone was probably mainly due. We found the same kind of ooze nearly free from coccoliths and rhabdoliths in what may be considered about a corresponding latitude in the north, to the west of Faröe.

Before leaving the subject of the modern chalk, it may be convenient to pass on to stations 158, 159, and 160, on March 7th, 10th, and 13th, on our return voyage from the ice. The first two of these, at depths of 1,800 and 2,150 fathoms respectively, are marked on the chart "Globigerina ooze;" and it will be observed that these soundings nearly correspond in latitude with the like belt which we crossed going southwards; the third sounding at a depth of 2,600 fathoms is marked "red clay."

According to our present experience the deposit of Globigerina ooze is limited to water of a certain depth, the extreme limit of the pure characteristic formation being placed at a depth of somewhere about 2,250 fathoms. Crossing from these shallower regions occupied by the ooze into deeper soundings, we find universally that the calcareous formation gradually passes into and is finally replaced by an extremely fine pure clay, which occupies, speaking generally, all depths below 2,500 fathoms, and consists almost entirely of a silicate of the red oxide of iron and alumina. The transition is very slow, and extends over several hundred fathoms of increasing depth; the shells gradually lose their sharpness of outline and assume a kind of "rotten" look and a brownish colour, and become more and more mixed with a fine amorphous red-brown powder, which increases steadily in proportion until the lime has almost entirely disappeared. This brown matter is in the finest possible state of subdivision, so fine that when, after sifting it to separate any organisms it might contain, we put it into jars to settle, it remained for days in suspension, giving the water very much the appearance and colour of chocolate.

In indicating the nature of the bottom on the charts, we came, from experience and without any theoretical consideration, to use three terms for soundings in deep water. Two of these, Gl. oz. and r. cl., were very definite, and indicated strongly marked formations, with apparently but few characters in common; but we frequently got soundings which we could not exactly call either "Globigerina ooze" or "red clay;" and before we were fully aware of the nature of these we were in the habit of indicating them as "grey ooze" (gr. oz.) We now recognise the "grey ooze" as an intermediate stage between the Globigerina ooze and the red clay; we find that on one side as it were of an ideal line, the red clay contains more and more of the material of the calcareous ooze, while on the other the ooze is mixed with an increasing proportion of "red clay."

Although we have met with the same phenomenon so frequently that we were at length able to predict the nature of the bottom from the depth of the sounds with absolute certainty for the Atlantic and the Southern Sea, we had perhaps the best opportunity of observing it in our first section across the Atlantic, between Teneriffe and St. Thomas. The first four stations on this section, at depths from 1,525 to 2,220 fathoms, show Globigerina ooze. From the last of these, which is about 300 miles from Teneriffe, the depth gradually increases to 2,740 fathoms at 500, and 2,950 fathoms at 750 miles from Teneriffe. The bottom in these two soundings might have been called "grey ooze;" for although its nature has altered entirely from the Globigerina ooze, the red clay into which it is rapidly passing still contains a considerable admixture of carbonate of lime.

The depth goes on increasing to a distance of 1,150 miles from Teneriffe, when it reaches 3,150 fathoms; there the clay is pure and smooth, and contains scarcely a trace of lime. From this great depth the bottom gradually rises, and with decreasing depth the grey colour and the calcareous composition of the ooze return. Three soundings in 2,050, 1,900, and 1,950 fathoms on the "Dolphin Rise," gave highly characteristic examples of the Globigerina formation. Passing from the middle plateau of the Atlantic into the western trough with depths a little over 3,000 fathoms, the red clay returned in all its purity: and our last sounding in 1,420 fathoms before reaching Sombrero, restored the Globigerina ooze with its peculiar associated fauna.

This section shows also the wide extension and the vast geological importance of the red clay formation. The total distance from Teneriffe to Sombrero is about 2,700 miles. Proceeding from east to west, we have

About 80 miles of volcanic mud and sand,
" 350 " Globigerina ooze,
" 1,050 " red clay,
" 330 " Globigerina ooze,
" 850 " red clay,
" 40 " Globigerina ooze;

giving a total of 1,900 miles of red clay to 720 miles of Globigerina ooze."

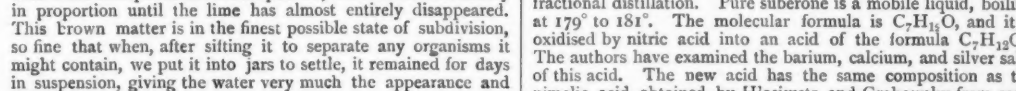
(*To be continued.*)

SCIENTIFIC SERIALS

THE *Journal of the Chemical Society* for October commences with a paper, by Prof. Roscoe, On a new chloride of uranium. The new compound is the pentachloride UCl_5, obtained by passing chlorine over a heated mixture of any oxide of uranium and charcoal. If the current of chlorine is slow, the substance forms dark needle-shaped crystals with a green metallic lustre and ruby red by transmitted light. When the chlorine is passed rapidly, UCl_5 is formed as a brown powder. The compound decomposes on heating into the tetrachloride and free chlorine.—The next paper is on suberone, by C. Schorlemmer and R. S. Dale. This body is formed by distilling suberic acid with lime according to the equation—

$$2C_8H_{14}O_4 = 2CO_2 + 2H_2O + C_{14}H_{24}O_2.$$

Hexane is produced at the same time, and can be separated by fractional distillation. Pure suberone is a mobile liquid, boiling at 179° to 181°. The molecular formula is $C_7H_{12}O$, and it is oxidised by nitric acid into an acid of the formula $C_7H_{12}O_4$. The authors have examined the barium, calcium, and silver salts of this acid. The new acid has the same composition as the pimelic acid obtained by Hlasiwetz and Grabowsky from camphoric acid, but its properties are quite different, and it has been provisionally named α-pimelic acid. The authors assign the following constitutional formulæ to suberone and α-pimelic acid:—



Suberone. α-Pimelic acid.

Note on the crystalline forms of meconic and α-pimelic acids, by Dr. C. A. Burghardt.—On the action of earth on organic nitrogen, by E. C. C. Stanford. The experiments were made on mixtures of lean meat with ordinary loam-earth, and the author deduces therefrom the following conclusions:—1. Earth mixed with organic nitrogenous matter is an indifferent dryer, and, except in considerable quantity, a poor deodoriser. 2. That the mixtures continuously lose nitrogen to about the extent of 73 per cent. in five months. 3. That the loss is perhaps wholly due to decay, the nitrogen being probably evolved as ammonia. 4. That in such mixtures the earth does not act as an oxidiser, no nitrification taking place.—The remainder of the journal is devoted to abstracts from foreign periodicals, many of which have been already noticed in these columns.

Gazzetta Chimica Italiana, fascicolo vi., vii., and viii., October.—This part begins with a long and valuable paper by W. Koerner, entitled "Studies of the Isomerism of the bodies known as Aromatic Substances with six Carbon Atoms." This research has led the author to study the action of nitric acid on acetanilide giving rise to the formation of nitro-acetanilide, which is converted by potassium hydrate into a mixture of ortho- and

meta-nitroaniline. Para-nitroaniline from ordinary dinitro-benzene is next treated of, then the reduction of meta-nitroaniline. Iodobenzene acted upon by nitric acid yields ortho- and meta-iodo-nitrobenzene, the first of which was converted by the action of nitro-sulphuric acid into a dinitro derivative, which, on treatment with a dilute solution of potassium hydrate, is converted into the potassium salt of ordinary dinitrophenic acid, and by the action of alcoholic ammonia into ordinary dinitro-aniline. From these reactions the author concludes that this dinitro-iodobenzene has the structural formula 1 : 2 : 4. Dinitro-iodobenzene from meta-nitro-iodobenzene has been prepared and proved to be identical with the foregoing body; at the same time a small quantity of a second dinitro compound is produced, which the author considers as the iodide of the β dinitrophenol of Huebner and Werner. The dinitro-aniline from this body has been prepared, and the constitution 1 : 2 : 6 is assigned to it. The author next enters into the consideration of this β dinitrophenol—a table comparing the fusion points of this body and its derivatives with those of the α compounds is given. The brominated derivatives of the aniline have been examined, and the constitution 1 : 2 : 4 assigned to the dibromo-aniline. A large section is next devoted to the three isomeric dibromo-benzenes; dichlorobenzene is also considered, and the three monobromo-toluenes. The action of bromine on the isomeric nitro-anilines has been studied, and constitutional formulæ are assigned to the resulting compounds. The author then goes on to consider the preparation of the new dinitrobenzene and the products of its transformations. The mono-nitro compound has been submitted to a similar study, and likewise the mono-nitro derivatives of the dichloro-, chloro-bromo-, chloro-iodo-, bromo-iodo-, and di-iodo-benzene. The next section is devoted to the constitution of the principal substitution products of phenol. The isomeric monobromophenols are first treated of, then the following bodies in succession:—dibromo-ortho-nitroanisol, the corresponding meta compound, Laurent's bromodinitrophenol, the dinitrochlorophenol of Dubois, and the corresponding bromo- and iodo compounds; finally, dinitro-para-dibromobenzene, its phenol and aniline. The three isomeric tribromobenzenes are next treated of: nitrotribromobenzene and the products of its decomposition. The constitution of the di-derivatives is discussed, and the present state of our knowledge with respect to the ortho-, para-, and meta-series of the aromatic compounds is well displayed in a series of tables. The remainder of this paper, of which the foregoing is but an imperfect outline, is entirely devoted to theoretical considerations.—The next paper is a preliminary note on the action of hydriodic acid on santonic acid, by S. Cannizzaro and D. Amato.—This is followed by a paper by the same authors on metasantonine, to which the formula $C_{15}H_{18}O_3$ is assigned.—Quantitative determination of the atomic group C_2H_3O contained in acetyl substitution products, by Fausto Sestini.—On the action of bromine on anhydrous chloral, by A. Oglialoro.—Allylate of chloral, by the same author.—Transformation of benzamide into benzoic aldehyde and alcohol, by Prof. J. Guareschi.—Action of sulphur on calcium carbonate, by E. Pollacci.—On the production of ozone by means of the electric discharge, by C. Giannetti and A. Volta.—On the necessity for searching for phosphorus in the urine in cases of poisoning, by F. Selmi. The same author contributes a paper on milk.—The concluding paper is by M. Mercadante, on the behaviour of tannic acid when used in agriculture.—The part concludes with notices of current foreign work in technical chemistry.

Bulletin de la Société d'Anthropologie de Paris, tome neuvième.—M. Dareste, in reply to the discussion which his paper on double or twin monsters (as given in a former number) had called forth, explains the nature of the observations on which his deductions were based. It would appear that after submitting nearly 8,000 hens' eggs to the process of artificial incubation, he obtained nearly 4,000 anomalies or monstrosities, but of these only about thirty were double embryos or twin monstrosities. A similar result has been observed in the case of osseous fishes; and Jacobi, who was the first to discover (in the course of the last century) the mechanism of fecundation among these fishes, had noted the proportion of twin monsters in fishes' eggs. His observations and those of Lerebouillet coincide with the result obtained by M. Dareste, that while external conditions may often determine the formation of simple monsters, they are absolutely without effect in regard to the evolutions of double monstrosities.—M. M. A. Bertrand, in a communication specially addressed to the Society, has propounded the novel hypothesis that the discovery of the manipulation of metals, as copper, tin, iron, silver, and lead, is due to Oriental peoples, with whom it was far advanced at a period when Europe was still in a state of barbarism. He, moreover, is of opinion that these arts came from a common centre by two channels, viz., the valley of the Dnieper and the valley of the Danube, in the latter of which the semi-barbarous Slavonic tribes still practise these arts very much as they first learned them from their Asiatic neighbours.—M. Hamy considers, in a short paper, the value as a distinctive palæontological character of the bifid condition of the canines in the Smeermaas jaw. He had frequently before noticed a transversal flattening in other fossil canines, and since his examination of the Smeermaas jaw he has found two other examples of this from the Quaternary period.—M. Broca discusses at length the influence of humidity on the form and dimensions of fossil crania, and deduces from his observations the general conclusions that the capacity of crania varies greatly in accordance with the hygrometric condition of their walls; that in drying, after removal from a humid soil, they undergo a considerable retraction, amounting in some instances to fully twenty cubic centimetres; that the walls of fossil crania are hygrometric; and that, consequently, no comparative observations of cranial capacity have any value unless all the crania have been exhumed for a space of many months.

THE August number of the *Bulletin de la Société d'Acclimatation de Paris* opens with a list of the various animals and plants which the society is prepared to lend to its members, with a view to establishing any new or rare forms of animal or vegetable life in different parts of the country. This is an organisation which might usefully be adopted in England.—A paper by M. B. Rico shows how varieties of Salmonidæ may be kept in enclosed waters, and points out—as Mr. Buckland has proved in England—that salmon and trout will keep in good condition in enclosed places with a good supply of food and of running water.—Dr. Turrel, in a paper entitled "Les Oiseaux et les Insectes," combats the theory of M. Perris that birds have very little effect in checking the increase of insects. He thinks that to the indiscriminate slaughter of small birds may be traced, to a certain extent, the spread of the Phylloxera.—Mr. R. Trimen contributes an interesting paper on the animals and useful plants of the Cape of Good Hope, from which it appears that there are no mammalia indigenous to South Africa which have been employed as beasts of burden; but the colony is rich in edible animals and valuable birds.—M. Cabonnier announces the arrival from India of several specimens of three varieties of fish never hitherto brought to Europe—the *Anabas scandens* or Climbing Perch, the Telescope Fish, and the Gourami.—The Phylloxera is the object of various notes and suggestions, with the view of providing some means of resting its progress.

Reale Istituto Lombardo, Rendiconti, vol. 7, fasc. viii.—Prof. Giovanni Cantoni contributes a note, "Researches on Heterogenesis." Ten years ago the Academy appointed a committee to investigate spontaneous generation, which from time to time reports its experiments. Dr. Grassi and Dr. Macagno, at Asti, have devoted themselves to the question of vinous fermentation. With saccharine solutions and new wine, they obtained the cryptogams characteristic of vinous fermentation. A certain number appeared in flasks hermetically sealed and heated for half an hour to 100°, and some occurred in flasks containing air filtered through cotton-wool, and washed both in sulphuric acid and an alkaline solution. These observers affirm that raising the temperature of wine does not destroy Pasteur's germs, owing to a special combination between the liquid and the small quantity of free oxygen remaining in the sealed vessel.—The next paper, On the limits of electrical resistance in non-conductors, is by the same author.—Prof. Giovanni Zoga gives an account of the Anatomical Museum of Pavia, which contains 638 preparations, of which 38 are complete skeletons, 26 male and 12 female, varying in age from the fœtus of two months to 101 years. Most of them are Italian, though two are German, one American, one Moor, and one Egyptian. There are 200 skulls and 400 portions of different skeletons. Of these skulls only 46 are females, and although the greater part are Italian, they include representatives of the various nations of Europe, Asia, and America, and of different social grades. The author mentions peculiarities seen in the several bones, and gives measurements of the skulls.—The last article is by Dr. Guido Grassi, and is devoted to the explanation of a new reflecting balance. This is a common balance with a reflector fixed above the index. He details experiments to show the way in which it may be used,

and its advantages in the physical laboratory, since the fiftieth part of a milligramme can be estimated by it quicker than by the ordinary method.

SOCIETIES AND ACADEMIES

LONDON

Physical Society, Nov. 21.—Dr. J. H. Gladstone, F.R.S., president, in the chair.—Prof. Macleod described a simple arrangement he had devised for showing internal resistance in battery cells. Two tubes about half a metre long, one of which is about twice the diameter of the other, are closed at their lower ends with corks. On the corks and within the tubes rest two discs of platinum foil connected with binding screws by platinum wires passing through the corks. The plates are covered with chloride of silver and the tubes are filled with a solution of chloride of zinc. Each tube is provided with a disc of amalgamated zinc soldered to a long insulated copper wire. The discs are cut so that they nearly fit the tubes, one being exactly double the diameter of the other, and therefore exposing four times the surface to the action of the liquid. On connecting the terminals with a galvanometer, the current will be found to increase as the distance between the zinc and platinum plates is diminished by lowering the zinc plate into the tube. In order to obtain the same deflection of the galvanometer by the narrow cell, the distance between the plates must be one-fourth those of the larger ones. The apparatus may also be used to show that opposed cells of the same kind will not produce a current. For this purpose the platinum plates are connected together and the two zinc plates joined to the galvanometer. No current will flow, whatever the distance between the plates.—Mr. James Baillie Hamilton, of University College, Oxford, made a communication on the application of wind to stringed instruments. Mr. Hamilton commenced with a short history of the efforts which had been made to bring the Eolian harp under human control, and explained how he himself had taken up the matter from Mr. John Farmer on leaving Harrow School. Mr. Farmer had succeeded in getting wind to do the work of a bow upon a string by attaching a reed to the end of it, forming thus a compound string from which a few notes of great beauty could be obtained. Mr. Hamilton, in attempting to complete a perfect instrument, soon found he had undertaken an almost impossible task, from difficulties which he explained to the Society. Failing to obtain advice or assistance, either from scientific men or from the musical instrument makers, he was once more thrown upon his own resources, and, conscious both of his responsibility and difficulties, resolved to leave for a time his university career, and to investigate to the uttermost a matter on which no information could be there obtained. The results of his investigations were then shown to the Society. After two years of labour, Mr. Hamilton had not only gained experience sufficient to perform what he had undertaken, but had also discovered that by a different mode of employing the same material, *i.e.* a string and a reed, he could secure for a string the advantages it afforded by an organ-pipe in addition to those which it already possessed. Showing a pianoforte string on a sound-board, he said: "Such strings already possess certain advantages; first, simplicity of reinforcement by a common sound-board; second, economy of space; third, blending of tone; and fourth, sympathy. Can I also secure for this string the advantages of an organ-pipe—namely, first, special reinforcement; second, volume of tone; third, choice of quality; and fourth, sustained sound?" Accordingly, an open diapason pipe was proposed for imitation, and, to the general surprise, the string was made to exactly imitate it in all these respects. Another string was next sounded, representing the note of the largest organ-pipe in use, in conjunction with other notes, satisfying the hearers that not only could a string do all the work of an organ-pipe in giving volume and sweetness to the note reinforced, but could afford the exquisite sympathetic and blending power hitherto peculiar to strings. Such notes were also sounded seven octaves apart. The reinforcement corresponding to the pipe was secured by the utilisation of a node which cut off from the string a segment corresponding to the note reinforced, presenting to all appearance the phenomenon of an organ built by nature out of a string. This node being a source of motion, is also utilised for gaining quickness of speech, since a cord, acting as a damper and stretched across the nodal line of a series of strings, serves to communicate instantaneous sound from key to key. Another invention of Mr. Hamilton's was a string which could not be put out of tune, to the great surprise of those who attempted to do so. He also exhibited a new pianoforte string, which by its purity and volume of tone showed that the results of a grand pianoforte could be obtained in a cottage instrument. Mr. Hamilton having satisfactorily answered several questions respecting possible objections, concluded by reminding the Society that it was in attempting faithfully to carry out the designs of another man that he was now in a position not only to perform what he had undertaken, but had also been permitted to bring into use a simpler, purer, and grander source of sound than had been contemplated when he laid his hand to a task which he was still engaged in perfecting.

Anthropological Institute, Nov. 24.—Prof. Busk, F.R.S., president, in the chair.—Col. Lane Fox exhibited and described specimens of stone implements, bows, arrows, and blowpipes from San José, Costa Rica. Mr. Charlesworth exhibited characteristic figures, carved in amalgam by Mexican miners, and a chaplet of gold and silver coins as worn by the women of Nazareth.—A brief paper by the late Mr. Cotesworth was read, On ruins in the neighbourhood of Palmyra; with Notes on some skulls found therein, by the President. The ruins described were groups of towers and tombs lying north and south of the Kuryelein road on the hills facing the castle. In one of these towers were discovered many skulls and other human remains, some of which were exhibited on the table. The date of their deposition could not, in the opinion of the author, be less than 1,800 to 2,000 years ago. There were also large underground tombs showing the same arrangements as in the towers. An examination of the remains by the President showed that they belonged to individuals of a dolichocephalic race of large rather than small stature, but by no means gigantic. A short time since Capt. Burton had forwarded skulls to the Institute presenting the same characteristics as the specimens under consideration.—Mr. W. Bollaert contributed Notes on some Peruvian antiquities, and exhibited a series of drawings and photographs in illustration, which he gave to the Institute.

MANCHESTER

Literary and Philosophical Society, Nov. 17.—Edward Schunck, F.R.S., president, in the chair.—Some remarks on Dalton's first table of atomic weights, by Prof. Henry E. Roscoe, F.R.S. This has already appeared in NATURE, vol. xi. p. 52.—Action of light on certain vanadium compounds, by Mr. James Gibbons.—On basic calcium chloride, by Harry Grimshaw, F.C.S.—On the structure of Stigmaria, by Prof. W. C. Williamson, F.R.S., which we hope to give next week.

PHILADELPHIA

Academy of Natural Sciences, July 21.—Dr. Ruschenberger, president, in the chair.—Prof. Persifor Frazer, jun., described a coal-cutting machine, designed by Mr. James Brown, of Brazil, Indiana. It consists of a steel or iron wheel, set in a frame, connected with the pneumatic engine, which runs in rails laid parallel to the face of the heading, which in this case may be several hundred yards long. On the outer periphery of this wheel are arranged twenty or thirty triangular-shaped pieces of steel, united with it at one of their apices by a pin. In the middle of the opposite side, which is curved, are firmly-fixed chilled-steel teeth, which set themselves by friction against the coal to the proper position for cutting, as the wheel is rotated to the right or left. The motion is imparted by means of a small-toothed wheel which moves in rack-work on the under-surface of the wheel.

July 28.—Dr. Ruschenberger, president, in the chair.—On report of the committees to which they had been referred, the following papers were ordered to be published:—Description of a new species of Helix, by James Lewis, M.D.—On some Batrachia and Nematognathi, brought from the Upper Amazon by Prof. Orton, by Edward D. Cope.—Notes on American Lepidoptera, with descriptions of twenty-one new species, by Aug. R. Grote.—Determination of the Species of Moths figured in the "Natural History of New York," by Aug. R. Grote, A.M.

Aug. 4.—Dr. Ruschenberger, president, in the chair.—Mr. Thomas Meehan exhibited some branches of *Acer Pennsylvanicum*, Lin. (*A. striatum*, Lamb), which had a remarkable system of dimorphic foliage. The first pair of leaves developed after the bursting of the bud in the spring, were larger and more perfectly developed than any subsequent ones. The next pair were usually lancelinear. Occasionally there was a tendency to the production of a pair of lobes, but usually the margins were

entire or sparsely serrulated. The third and subsequent pairs of leaves partook of the form of the first pair, though seldom so large. It was worthy of remark, that in plants with alternate leaves, the leaves with their axial buds were generally about the same size. In some few instances there were variations in the size, especially in the $\frac{1}{3}$ arrangement of the leaves on the stem. In opposite leaved plants the rule was the other way; one bud or one leaf, either in the blade or petiole, being larger or longer than the other. In the maples this was especially the case. At times the petioles in some cases would be not more than half the length of the opposite. He had found this especial peculiarity, however, in no other species but *A. Pennsylvanicum* that he had been able to examine, which included most in common cultivation. It might be in *A. spicatum*, Lam., which he had not been able to examine this season, and which he supposed to be but a variety of *A. Pennsylvanicum*.

Aug. 25.—Dr. Ruschenberger, president, in the chair.—Prof. Leidy exhibited a living specimen of the freshwater ciliated polyp, formerly described by him under the name of *Pectinatella magnifica*. Pectinatella is by far the largest of all the known freshwater ciliated polyps, and, indeed, is not surpassed by any of the marine forms known to us. It has not been determined whether the huge Pectinatella colonies start each from a single individual, or are the result of the confluence of a number of small colonies. On the approach of winter the colonies die and undergo decomposition, in which process the remarkable winter eggs or statoblasts are liberated. These are provided with anchor-like spines, by which, as in the case of the eggs of skates and sharks, they become attached to various fixed bodies. In examining various common animals of our household, Prof. Leidy had found a thread-worm infesting the common house-fly. The worm is from a line to the tenth of an inch long, and lives in the proboscis of the fly. It was found in numbers from one to three in about one fly in five. The parasite was first discovered in the house-fly of India, by the English naturalist, Mr. H. J. Carter, who described it under the name of *Filaria muscæ*, and suggested the opinion that it might be the source of the Guinea worm, *Filara medinensis*, in man. Mr. Carter states that he found from two to twenty of the worms in one fly of three. Dr. Diesing referred the parasite to a new genus with the name of *Habronema muscæ*. The singular position in which the worm lives suggests the many unsuspected places we have to search to find the parents or offspring of our own parasites.

PARIS

Academy of Sciences, Nov. 16.—M. Bertrand in the chair.—The following papers were read:—On a new class of organic compounds, the carbonyls, and on the true function of ordinary camphor, by M. Berthelot. The author classes as carbonyls the three bodies, ordinary camphor, oxide of allylene, and diphenylacetone.—Action of heat on ordinary aldehyde, by M. Berthelot.—On the carpellary theory according to the Liliaceæ and the Melanthaceæ, by M. A. Trécul.—On wounds from trepanning and their dressing, by M. C. Sédillot.—Observations on the November shooting stars, by M. Leverrier.—On the age of the Pyrenean red sandstone and relationship to the Saint-Béat statuary marble, by M. A. Leymerie.—On electric induction, by M. P. Volpicelli.—Action exercised by an electro-magnet on the spectra of rarefied gases traversed by the electric discharge, by M. J. Chautard. The author has hitherto examined only the spectra of metalloids. The magnet appears to influence the number, position, fineness, &c., of the spectral lines in a special manner for each element.—Note on magnetism and on a new exploding fuse, by M. Trève.—On the circulatory system of the Echinidæ, by M. Edm. Perrier.—Note on the manufacture of paper from *gombo* (*Hibiscus esculentus*), and on the industrial uses of this plant, by M. Ed. Landrin.—On the relationship existing between the chemical composition of the air in the swim-bladder and the depth at which the fish are taken, by M. A. Moreau.—Unwholesomeness of the Seine in August, September, and October, 1874, by M. Boudet.—Method pursued in searching for the most efficacious substance for resisting Phylloxera at the viticultural station of Cognac, by M. Max Cornu.—Effects produced by the first frosts on the phylloxerised vines in the vicinity of Cognac, by M. Maurice Girard.—A despatch was read from the French Minister at Pekin, and a letter from M. Fleuriais, announcing the safe arrival and installation of the Transit of Venus Expedition in that city.—On two points in the theory of substitutions, by M. C. Jordan.—On fluorene, by M. Ph. Barbier. The formula for this hydrocarbon is $C_{26}H_{10}$. The author has examined many of its derivatives.—On the marsupium of the eye of birds, by MM. J. André and Beauregard.—New method for the antiseptic occlusion of wounds, by M. Sarazin.—On the mutability of microscopic germs and on the passive function of the organisms classed as *ferments*, by M. J. Duval.—The carboniferous limestone soil of the Pyrenees, by M. Henri Magnan.—The shooting stars of November 1874, by M. Chapelas.

Nov. 23.—M. Cl. Bernard in the chair.—The following papers were read:—Meridional observations of the minor planets made at Greenwich Observatory (forwarded by Sir G. B. Airy, Astronomer Royal) and at the Observatory of Paris during the third quarter of the year 1874, communicated by M. Leverrier.—M. H. A. Weddell communicated a botanical note on the algolichenic theory.—Note on the gum-bearing Acacia of Tunis, by M. Doûmet-Adanson.—On new improvements in magneto-electric machines, by M. Z. T. Gramme.—On the saccharine matter contained in mushrooms, by M. A. Müntz.—Effects of potassium sulphocarbonate on Phylloxera, by M. Mouillefert.—M. Max Cornu presented a paper containing the continuation of his researches for the most efficacious substance for the destruction of Phylloxera.—Experiments made on branches of vine immersed in water containing various substances in solution, by M. A. Baudrimont.—Facts relating to Phylloxera and to the submersion of vines and cereals; application of M. Naudin's process to vines that cannot be submerged, by M. G. Grimaud.—On the stability of the equilibrium of a heavy body resting on a curved support, by M. C. Jordan.—Influence of temperature on the coefficient of capillary flowing of liquids, by M. A. Gueront.—On the product formed by the addition of hypochlorous acid to propylene, by M. L. Henry.—On the Actiniæ of the oceanic coasts of France, by M. P. Fischer.—New researches on the organogenesis of *Lophospermum erubens*, by M. Frémineau.—M. E. Duchemin communicated a note concerning the invention of the circular compass.—During the meeting the perpetual secretary announced to the Academy the safe arrival at Sydney of MM. André and Angot, the members of the Transit of Venus Expedition who are to observe this phenomenon from Noumea.

BOOKS AND PAMPHLETS RECEIVED

BRITISH.—Report of Newcastle-on-Tyne Chemical Society.—The Aërial World: G. Hartwig (Longmans).—Transits of Venus: R. A. Proctor, B.A. (Longmans).—Descent of Man (New Edition): Charles Darwin, M.A., F.R.S. (J. Murray).—Transactions of the Institute of Engineers and Shipbuilders in Scotland. Report on Safety Valves.—Chambers's Information for the People (W. and R. Chambers).—The Origin of Civilisation and the Primitive Condition of Man: Sir John Lubbock, Bart., M.P., F.R.S. (Longmans).—Elements of Embryology: M. Foster, M.A., M.D., F.R.S., and F. M. Balfour, B.A. (Macmillan and Co.)

AMERICAN.—Relation between the Barometric Gradient and the Velocity of the Wind: Wm. Ferrel, A.M. (Washington, U.S.)—Complete Works of Count Rumford, vol. iii. (Boston, U.S.)—Proceedings of the American Society of Arts and Science (John Wilson, Boston).—Proceedings of the American Philosophical Society (Philadelphia).—Annotated List of Birds of Utah: H. W. Henshaw (Salem, U.S.)—Report of Explorations of 1873 of the Colorado of the West: Prof. J. W. Powell (Washington).—Synopsis of the Flora of Colorado: T. C. Porter (Washington).

FOREIGN.—Correspondenzblatt des Naturforscher-Vereins zu Riga.—Observacions magneticas y Meteorologicas (Havana, Cuba).

CONTENTS

DIARY OF SOCIETIES.

LONDON

THURSDAY, DECEMBER 3.

LINNEAN SOCIETY, at 8.—Observations on Bees and Wasps: Sir John Lubbock, Bart., F.R.S.—On the Classification of Animals: Prof. Huxley, F.R.S.

CHEMICAL SOCIETY, at 8.—On the Colour of Cupric Chloride: W. N. Hartley.—On the Formulæ of the Alums: S. Lupton.

FRIDAY, DECEMBER 4.

GEOLOGISTS' ASSOCIATION, at 8.—On the Conditions which determine the presence or absence of Animal Life on the Deep-Sea Bottom: Dr. W. B. Carpenter, F.R.S.

SATURDAY, DECEMBER 5.

PHYSICAL SOCIETY, at 3.—On a Strophometer: T. Hearson.—On a method of demonstrating the Expansion of Solids: Prof. G. C. Foster.—On the Electrolysis of certain Metallic Salts: Dr. J. H. Gladstone and A. Tribe.

MONDAY, DECEMBER 7.

ENTOMOLOGICAL SOCIETY, at 7.

ROYAL INSTITUTION, at 2.—General Monthly Meeting.

SOCIETY OF ARTS, at 8.—Cantor Lecture; Alcohol, its Action and Use: Dr. B. W. Richardson, F.R.S.

TUESDAY, DECEMBER 8.

PHOTOGRAPHIC SOCIETY, at 8.

ANTHROPOLOGICAL INSTITUTE, at 8.—Notes on some Tumuli and Stone Circles, near Castleton, Derbyshire: Rooke Pennington, LL.D.—Some account of a Leaf-wearing Tribe on the Western Coast of India: M. J. Walhouse.—Further notes on the Stone Monuments of the Khasi Hills: Major Godwin-Austen.

WEST LONDON SCIENTIFIC ASSOCIATION, at 8.—Physical Geography of the Ocean: Dr. J. Foulerton.

METROPOLITAN SCIENTIFIC ASSOCIATION, at 7.

ATHENÆUM LITERARY AND SCIENTIFIC SOCIETY, at 8.—The Life of the Coal Period: Prof. Morris.

WEDNESDAY, DECEMBER 9.

SOCIETY OF ARTS, at 8.—The Protection of Buildings from Lightning: Dr. R. J. Mann.

INSTITUTION OF CIVIL ENGINEERS, at 8.

THURSDAY, DECEMBER 10.

MATHEMATICAL SOCIETY, at 8.—Two Letters from M. Mannheim on Three and Seven Bar Motion. Communicated by J. J. Sylvester, F.R.S.—On the Potentials of Polygons and Polyhedra: Prof. Cayley, F.R.S.

EDINBURGH

THURSDAY, DECEMBER 3.

GEOLOGICAL SOCIETY, at 8.—On Phenomena of Weather Action and Glaciation exhibited by the Alps of Switzerland and Savoy: Ralph Richardson.—On the different convulsions which the Earth's Crust has undergone since the deposition of the Old Red Sandstone: G. H. M. Binning Horne.

LEEDS

MONDAY, DECEMBER 7.

GEOLOGICAL ASSOCIATION, at 8.—The Antiquity of Man: Dr. H. A. Allbutt.

TUESDAY, DECEMBER 8.

NATURALISTS' FIELD CLUB, at 8.—Council Meeting.

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